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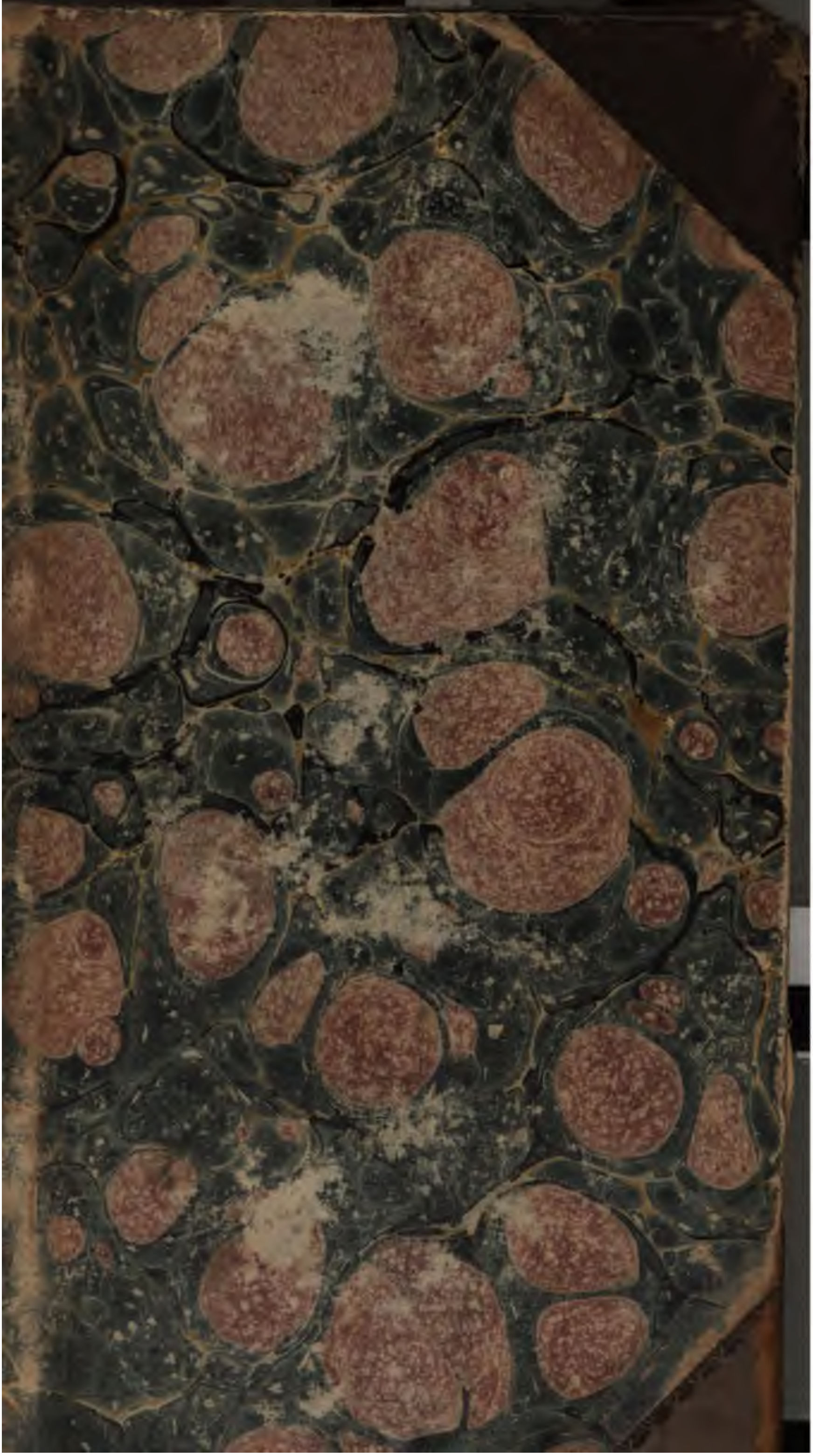

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ON

NAVAL TIMBER.

ON

NAVAL TIMBER

AND

ARBORICULTURE;

WITH CRITICAL NOTES ON AUTHORS WHO HAVE
RECENTLY TREATED THE SUBJECT OF

PLANTING.

BY PATRICK MATTHEW.

EDINBURGH:
ADAM BLACK, 55, NORTH BRIDGE; AND LONGMAN,
REES, ORME, BROWN, AND GREEN, LONDON.
MDCCCXXXI.

ON

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PREFACE.

It may be thought presumptuous in a person who has never had the curiosity to peruse the British classic authors on planting and timber—Evelyn, Hanbury, Marshall, Miller, Pontey—to make experiment of the public sufferance. The author does not, however, think any apology necessary; as, if the public lose time unprofitably over his pages, he considers the blame attachable to them, not to him. A writer does not obtrude as a speaker does, but merely places his thoughts within reach.

As the subject, notwithstanding its great importance, might, *per se*, be felt dry and insipid by the general reader, accustomed to the luxuries of modern literature, the author has not scrupled to mix with it such collateral matter as he thought might serve to correct the aridity. The very great interest of the question regarding species, variety, habit, has perhaps led him a little too wide.

There is one advantage in taking a subject of this kind, that few professional (literary) critics can meddle with it, further than as regards style and language, without exposing their own ignorance. Yet will the author experience the highest pleasure in being instructed and corrected, wherever his knowledge may be found defective, or when speculation or misconception of facts have led him into error. Knowledge and truth, is mental strength and health; ignorance and error, weakness and disease: the man who pursues science for its own sake, and not for the pride of possession, will feel more gratitude towards the surgeon who dislodges a cataract from the mind's eye, than towards the one who repairs the defect of the bodily organ.

GOURDIE-HILL BY ERROL,
Sept. 10. 1830.

CONTENTS.

INTRODUCTION, ... Page 1

PART I.—STRUCTURE OF VESSELS.

SECTION I.—PLANK.

Figure, dimensions, and quality of timber suitable, . 5
British trees suited for plank, . . . 7
Directions for training and pruning plank timber, . 8

SECTION II.—TIMBERS, . . 14

Most suitable dimensions, ... 18
Figures of bends and crooks, ... 19
British trees suited for timbers, . . . 21

PART II.—BRITISH FOREST TREES SUITED FOR NAVAL PURPOSES.

Oak—Quercus, ... 31
Spanish Chestnut—Castanea vulgaris, . . 42
Beech-tree—Fagus sylvatica, . . . 48
Scotch Elm—Ulmus montana, . . . 50
English Elm—Ulmus campestris, . . . 54
Red-wood Willow—Salix fragilis, . . . 58
Red-wood Pine—Pinus, ... 63
White Larch—Larix communis, pyramidalis, . 75
  Investigation of the causes of the rot in larch, . 78
  Soils and subsoils most suited for larch, . . 82
Soils and subsoils where larch generally takes rot, . 86
  Remarks on open draining, . . . 88
  Bending and kneeing larch, . . . 90
  New plan of forming larch roots advantageously into knees, ... 94
  Uses of larch, and value as a naval timber, . 97

PART III.—MISCELLANEOUS MATTER CONNECTED WITH NAVAL TIMBER.

NURSERIES, ... P. 106
Infinite variety existing in what is called species, ib.
Injurious effect from selecting the seed of the inferior varieties for sowing, . . . 107
Injurious effect from kiln-drying fir cones . ib.
A principle of selection existing in nature of the strongest varieties for reproduction, . . 108
Injurious effect from the plants spindling in the seed-bed and nursery line, ... 109
Injurious effect from cutting the roots and from pruning, ... 111
A light soil and open situation best suited for a nursery, ... ib.
Wide diverging root-leaders necessary to the large extension of a tree, . . . 112

PLANTING, ... 114
Further observations on pruning, . . . 117
Observations on timber, . . . 122
Table of the number of sap-growths of different kinds of timber, ... 124
Remarks on laburnum, ... 126
Height to which trees may be trained of clear stem, 128

CONCERNING OUR MARINE, ... 130
Causes which befit Britain for being the first naval power, and the emporium of the world, . 131
Utility of a system of universal free trade, . 133
Absolute necessity of abolishing every monopoly and restriction on trade in Britain, . . 134
Our marine not represented in Parliament, and the consequences, ... 135
Insane duty on the importation of naval timber and hemp, ... 136

PART IV.—NOTICES OF AUTHORS WHO TREAT OF ARBORICULTURE.

Utility of a general review of these authors, P. 138

I.—FORESTER'S GUIDE, BY MR MONTEATH, . . 140

Advantage of converting our coppice oak into forest, and of saving our home oak in time of peace, 140

Plan, by Mr Monteath, of preparing peat soils for planting, ... 142

———— of covering bare rocky ground with timber, 143

———— of raising oak-forest or copse by layers, 144

Influence of our vernal eastern breeze on vegetation, 146

Cause why the trees of narrow belts seldom grow to large timber, ... 148

Observations on pruning and thinning, . . 150

Observations on the age at which the valuable part of oak bark is thickest, ... 154

Observations on the prevention of dry-rot, . 157

II.—NICOL'S PLANTER'S CALENDAR, . . . 163

Different influence of transplanting on herbaceous and woody vegetables, ... 164

Cutting the roots close in, injurious to some trees and not to others, ... 165

Mr Sang's plan of raising forest from the seed *in situ*, 167

Reasons which render the planting of young trees preferable to sowing *in situ*, . . . 168

Mr Sang's directions for nursery practice; sowing the different kinds of forest trees in the seed-bed; removing the seedlings to the nursery line, and from thence to the field, . . . 170

Remarks on transplanting, . . . 178

III.—BILLINGTON ON PLANTING, . . . 181

An account of the management of the Royal Forests, ib.

Reasons why government should rather purchase than raise timber, and that they should sell off the Royal Forests, ... 182

The Billingtonian system of pruning, . P. 185

Remarks on planting soils not easily permeable by water, ... 187

Mr Billington's directions for planting these soils, 188

——— for clearing away weeds, and for cutting in or pruning the points of the branches, . 189

IV.—Forsyth on Fruit and Forest Trees, . 192

Mr Forsyth's surgery of trees, and the value of his composition-salve, ... ib.

Manner in which a tree can be transformed from disease and rottenness to health and soundness, 193

V.—Mr Withers, ... 198

Discomfiture of our Scottish Knights by Mr Withers, ib.

Account of a number of facts and experiments by the writer, on the comparative strength of quick and slow grown timber—on the influence of circumstance and age in modifying the quality of the timber—on the difference in the quality of different varieties of the same species, and of different parts of the same tree, . . . 199

Oak timber, moderately fast grown, so that it may be of sufficient size, and still retain the toughness of youth, best suited for naval use, . . 214

Mr Withers, his literary friends and Sir Henry Steuart equally imperfectly acquainted with the subject in dispute between them, . . . 215

The Withers' system neither necessary nor economically suited for the greater part of Scotland, . 217

Fallacy of experiments on the strength of timber, from not taking into account the difference of tension of the different annual layers, and their position, whether flat, perpendicular, &c. . . 221

VI.—Steuart's Planter's Guide and Sir Walter Scott's Critique, ... 226

Importance of whatever may serve to amuse the second childhood of the wealthy, . . . 227

The subject—the art of moving about large trees in general, merely a pandering to our wilfulness and impatience, ... P. 227
Intolerable dulness of the park and smooth lawn, 228
Delightful sympathies with the objects and varied scenery of our *peopled* subalpine country, . 229
Sir Walter Scott's curious effort to give consequence to the art of moving about large trees, . . 231
Paroxysm of admiration of Sir Walter, at Sir Henry's discoveries, with his hyperbolic figures of comparison, ... 233
Account of the writer's practice in moving trees of considerable size, ... 235
Taste of Sir Walter Scott for "home-keeping squires," practisers of the Allanton system, . 245
What a British gentleman should be, . . 246
The Allanton practice described, . . 249
Quotation from Sir Henry Steuart's volume, in which the philosophy of his practice is described, 254
Summary of Sir Henry's discoveries, . . 264
Consideration of the accuracy of some of Sir Henry's assertions regarding the desiccated epidermis of trees, and the elongation of the shoots of plants, 265
Sir Henry's assertion that quick-grown timber is inferior to slow-grown, and that culture necessarily renders it softer, less solid, and less durable, not correct, ... 282
The present climate of Scotland, and of the Orkneys and Shetlands, inferior to a former, ... 287
That this may have been owing to these islands having once been a portion of the continent, . 288
The recent advance and recession of the German Ocean, render a former junction with the continent not improbable, ... 289
Mr Loudon's statement, of the effect produced by pruning on the quality and quantity of the timber, that trees *produce* the best timber *in their natural locality, not* supported by facts, . 305

The apparent use of the infinite seedling varieties of plants, ... P. 307

VII.—CRUICKSHANK'S PRACTICAL PLANTER, . 309

Advantages of laying ground under timber, stated rather too high by Mr Cruickshank, . . ib.

Mr Cruickshank's account of the superior fertilizing influence of forest upon the soil, . . 310

Facts which in many cases lead to an opposite conclusion, ... 316

An examination into the causes which promote or retard the formation, or which tend to dissipate the earth's covering of vegetable mould, . 316

Account of an uncommon system of fallowing once practised in the Carse of Gowrie, . . 324

High manuring quality of old clay walls, . 325

Formation of nitre the probable cause of the fertilizing quality of these walls, . . ib.

The fertilizing influence of summer fallow may in part be owing to the formation of nitre and other salts, ... ib.

That there is a deficiency of these salts in some places of the world, and an excess in others, . . 326

Ignorance of Mr Cruickshank regarding the location of certain kinds of trees, . . . 327

Mr Cruickshank's reprehension of the practice of covering fir seeds half an inch deep in England, and and of *forcing* suitable earth for nurseries where awanting. 330

Best method of transplanting seedlings in the nursery row, ... 331

Quotation worthy the attention of planters, . ib.

Error of authors on the location of trees, in inculcating a determinate character of soil as generally necessary for each kind of tree, . . 334

Further errors of Mr Cruickshank on the location of trees, ... 335

Adaptation of Scots fir to moist soils, even to peat-*moss*, ... 338

An account by Mr Cruickshank of the most economical and successful mode of planting moors and bleak mountains, . . . P. 340
Method of planting by the flat dibble or single notch, 343
——— by the double notch or cross-slitting, 344
Expense and comparative merits of each, . . 345
These methods of planting best adapted for a sterile country, where the weeds are small, . . 346
Practice by the writer of cultivating young plantation by the plough, suited for rich soil, . 347
Best season for planting moist soils, . . 348
Manner in which frost throws up the young plant from the soil, ... 349
Mr Cruickshank's plan of raising oak forest *in situ* from the seed, ... 351
That although the bare plan given by our author, of sowing *in situ*, under the shelter of nurses, is good, his directions for executing it are not very judicious, ... 352
Advantages of this plan which Mr Cruickshank has not noticed, ... 353
That the power of ripening seed is not increased by shelter in proportion to the power of growing, 356
That the line of seed ripening, and not the line of growing, regulates the natural distribution of plants in respect to climate, . . 357
That oaks, under this plan of sowing *in situ* under shelter, can be extended to a climate inferior to the natural, ... ib.
That oaks grown in the low country, and best climate of Scotland, appear not to ripen the seed sufficiently. Thence the probability that oak now would not even keep its present locality in the low country of Scotland, although it may "be taught to rise in our" alpine country, . . . 358

APPENDIX.

Note A.—That universal empire is practicable only under naval power, . . . P. 363

Note B. On hereditary nobility and entail, . . 364

Note C. Instinct or habit of breed, . . . 369

Nautical and roving disposition of the superior breed which has spread westward over the maritime provinces of Britain, and over nearly the whole continent of North America, . . 370

Influence of change of place, . . . 371

Influence of civilization and confinement upon the complexion, ... 372

Difference of character between the population of the northern and southern maritime provinces of Britain, ... 373

That the middle and southern portion of the North Temperate Zone is not so favourable to human existence as the northern portion, . . 375

Note D. Use of the selfish passions, . . 376

Note E. Injudicious measurement law of the tonnage of vessels, rendering our mercantile marine of defective proportions, ... 377

Note F. On the mud depositions or alluvium on the eastern coast of Britain, . . . 378

Probability that a delta of this alluvium, a continuation of Holland, had at one time occupied the entire German Ocean, ... 379

Accommodation of organized life to circumstance, by diverging ramifications, . . . 381

Retrospective glance at our pages, . . . 388

INTRODUCTION.

NAVIGATION is of the first importance to the improvement and perfecting of the species, in spreading, by emigration, the superior varieties of man, and diffusing the arts and sciences over the world; in promoting industry, by facilitating the transfer of commodity through numberless channels from where it is not, to where it is required; and in bearing the products of those most fertile but unwholesome portions of the earth, to others more congenial to the existence of the varieties of man susceptible of high improvement: Water being the general medium of action,—fluidity or conveyance by water, almost as necessary to civilized life as it is to organic life, in bearing the molecules forward in their vital courses, and in floating the pabulum (the raw material) from the soil through the living canals to the manufactories of assimilized matter, and thence to the points of adaptation.

As civilization progresses under the influence of navigation, and the earth exchanges her straggling hordes of savages for enlightened densely-peopled nations, every climate and country will be more set apart to its appropriate production, and the utility of the *great conduit, the* OCEAN, will more and more be developed, and become the grand theatre of contested dominion—superiority there being almost synonymous with ***Universal Empire***—dry land only the footstool of the ***Mistress of the Seas*** *.

In the still hour which has followed the cannon roar of our victories, we seem disposed to sleep secure, almost in forgetfulness, that we possess this superiority, that we stand forth the Champion of the World, and must give battle to every aspirant to the possession of the *trident sceptre.*

As soon as the recent principles of naval motion and new projectiles, conjoined to shot-proof vessels, shall have been brought to use in naval warfare, marine will have acquired a great comparative preponderance over land batteries, and every shore be still more at the mercy of the Lords of Ocean.

When we consider the tendency of luxurious peace, the effeminacy thence flowing in upon many of our wealthier population,—when we view, on the one hand, an entailed aristocracy *, whose founders had been gradually thrown uppermost in more stirring times, the boldest and the wisest, but whose progeny, "in a calm world" entailed to listless satiety, have little left of hope or fear to awaken in them the dormant energies of their ancestors, or even to preserve these energies from entirely sinking; and, on the other hand, an overflowing population, chained, from the state of society, to incessant toil, the scope of their mental energies narrowed to a few objects from the division of labour, all tending to that mechanical order and tameness incompatible with liberty; thus, perhaps, equally in danger of deteriorating and sinking into *caste*, both classes yielding to the natural law of restricted adaptation to condition:—when we reflect on this, the conclusion is irresistibly *forced* upon us, that the periodical return of war is indispensable to the heroic chivalrous character and love of freedom which we have so long maintained, and which (Britain being the first in name and power in the family of nations) must be so influential on the *morale* of the civilized world. It is by the jar and struggle of the conflict that the baser alloy and rust of our manners and institutions must be removed and rubbed away: it is by the ennobling excitement of danger and of hardship that our generous passions must be cherished, and our youth led to emulate the Roman in patriotic thirst for glory—the Spartan in devotion—their own ancestor, the more daring Scandinavian sea-king or rover*, in adventurous valour. Without, however, seeking the fight, yet in preparation for the perhaps not distant time, when we shall face another foe, it behoves us, without any sickly sentimentality, to cherish our warlike virtues—above all things to attend to what must constitute "the field of our fame," *Our* MARINE, and the material of its construction, *Naval Timber*.

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* See App. A.

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* See App. B.

* See App. C.

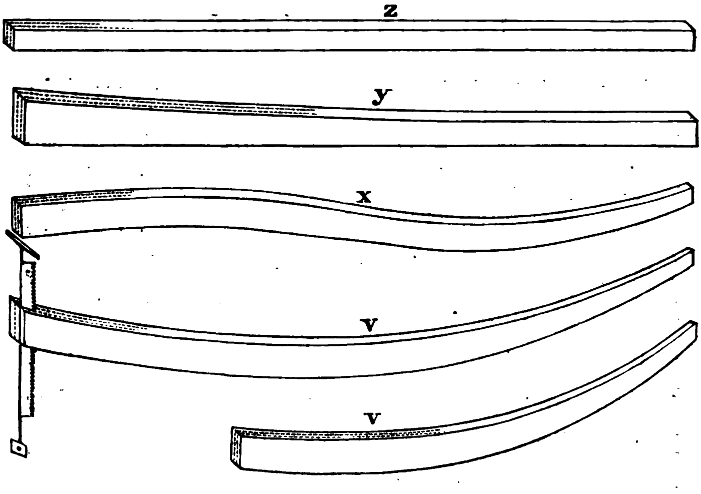
PART I.

STRUCTURE OF VESSELS.

VESSELS are constructed of wood under two forms, *Plank* and *Timbers;* Plank, the out and inside skin of the vessel—Timbers, the ribs or frame which support the plank.

SECTION I. PLANK.

TREES intended for plank ought to be reared in close forest, or protected situation, drawn tall and straight, or what is preferable for a part, with a gentle regular bend, technically *sny,* Figs. v and x, (next page). It requires to be of clean solid texture, from 12 to 40 feet in length, and at least 8 inches in diameter at small end, or any greater thickness. For the conveniency of transport, oak plank timber is generally squared or planked where grown, and is cut out from 2½ to 7 inches in thickness, and from 6 to 18 inches in breadth. Plank is needed of such various dimensions, that any oak tree of clean timber, nearly straight one way, and straight, or with a gentle regular bending, the other, may safely be cut into plank, the section to be in the plane of the curve. Figs. v, x, y, z, represent the most advantageous forms of logs for cutting into plank. The dotted lines shew the section of the saw in planking: the straighter the log is in the plane of the saw, it is the more suitable, as the planks bend sufficiently *side*-way by steaming; Fig. v, of considerable bend and taper, where the planks, when cut, have a bend *edge*-way, is the most valuable: this form requires to be very free of knots. In straight planks, Fig. z, cleanness from knots is not such a desideratum.



Figs. z, y, of any length—best long; x, from 25 to 35 feet; v, v, from 12 to 24 feet.

In the above cut, for distinctness, the saw is drawn entering the butt. In practice it enters the top.

When planks are cut out where grown, they are sawn from the round log immediately after it is felled and barked, which not only prevents injury from drought-cracks, but produces also a considerable saving of timber and labour, as the wood is softer when green; and the centre planks can thus be had much broader than after squaring the log. The outer part of the matured or red wood, which is partly cut away in squaring, is also the cleanest for bending. The sap or not sufficiently matured wood, when left on the side of the plank in the vessel, wherever it is not always soaking in water, is only useful to the shipwright, as it decays in two or three years, and demands an expensive repair. When plank timber is squared, it is for the conveniency of carriage and stowage, and where timber is of little value.

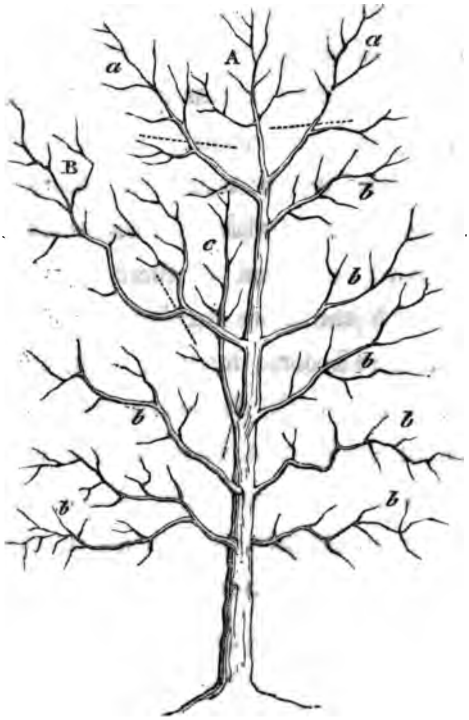
Of British trees suited for plank, the most valuable are oak, Spanish chesnut, larch, red wood pine, and sometimes beech *, elm, plane (*Acer pseudo-platanus)* under water. As no timber decays under water for a considerable length of time, when put in fresh, unless it be devoured by the sea-worm, beech or any other hard tough wood is nearly equally good as oak for outside plank under light water-mark, provided the timber be hastened out of the bush into the vessel, or be kept in pools, either in log or plank, till used, or be planked, and the plank kept dry under cover. One summer on the ground will generally render a beech log in the bark useless.

---

* Beech, suited for plank, is sometimes of more value when straight and of considerable length for the purposes of keel-pieces; for this the log requires to be from 30 to 70 feet in length, and at least of sufficient thickness at the small end to square a foot.

DIRECTIONS * FOR TRAINING PLANK TIMBER.

Divide all branches into leaders and feeders; leaders, the main or superior shoots which tend to become stems, A, *a*, *a*; feeders, the inferior branches, B, *b*, *b*, *b*.



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* These directions are generally applicable—as well for what may be required for being bent for compass-timbers, and for what may be used for land purposes, as for plank.

Should more than one leader appear from the time of planting the tree till it attain the required height for the plank, shorten all but the most promising one down to the condition of feeders, making the section immediately above a twig, preferring one which takes a lateral or horizontal direction. Vide dotted line crossing *a*, *a*.

Should any feeder, below the required height, become enlarged beyond its compeers, such as B, reduce it to equality (*vide* dotted line), or prune it close off, if this should be necessary to the symmetry of the tree.

Cut off, close by the trunk, all shoots which rise at a very acute angle with the main stem, such as C. There is a triple reason for this: they rise up and interfere with the more regular horizontal feeders, tending also to become leaders; they do not form a proper junction with the stem, by reason of the wood, as it swells, not being able to throw up the bark out of the narrow angle; thence the bark of both stem and branch is enclosed in the confined breek, and the wood never unites *, thence disease is liable to be generated between them, or they are subject to be torn down by the wind; and should they ultimately come to be removed, being then of considerable size, and the section from their perpendicular position being partly horizontal, as the sides of the wound swell up, the rain lodges in the centre, and generates rot. These nearly perpendicular branches generally originate from improper pruning, springing out where a large branch has been cut away.

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* There are several valuable varieties of apple-trees of acute branch angle, which do not throw up the bark of the breeks; this either occasions the branches to split down when loaded with fruit, or, if they escape this for a few years, the confined bark becomes putrid, and produces canker, which generally ruins

Lop off all branches, which, by taking an irregular direction, incline to rub upon the more regular; also remove all splintered, twisted, and diseased branches.

Do not cut away any of the lower branches (feeders) till they become sickly or dead. By pruning these prematurely, you destroy the fine balance of nature, and throw too much vigour into the top, which in consequence puts forth a number of leaders. You also diminish the growth of the tree by the loss of healthy feeders; the timber of the tree increasing in proportion to the quantity of healthy branches and foliage (the foliage being the stomach and lungs

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the tree. We have remedied this by a little attention in assisting the rising of the bark with the knife. Nature must not be charged with the malformation of these varieties; at least, had she formed them, as soon as she saw her error she would have blotted out her work.

of the plant). You also, by diminishing the number of feeders, increase the comparative size of those remaining, which throws the upper part of the stem into large knots, improper for plank, and renders their future excision dangerous, as large feeders, when circumstance or decay require their removal, or, when they are rifted off by winds or snow, leave wounds which often carry corruption into the core of the tree.

After the tree has acquired a sufficient height of bole for plank, say from 20 to 60 feet, according to circumstance of exposure, climate, &c., and also as many branches above this height as may be thought necessary to carry on advantageously the vital functions, as the superior head will now sustain small injury by being thrown out into large branches and plurality of leaders, (if it be oak it will become more valuable by affording a number of small crooks and knees); it will then be proper, in order to have timber as clean as possible, and regularly flexible, to lop clean off all the branches on the stem as far up as this required height. From the early attention to procure very numerous feeders, and to prevent any from attaining large size, the wounds will very soon be closed over, leaving no external scar, and as little as possible of internal knot or breaking off of fibre. There are many salves, panaceæ, and pigments in use for covering over the section of removed branches, which in ordinary cases may occasion no injury, but they are unsightly. In wounds of beech trees where the cut tubes are so prone to die downward a considerable way into the stem and to generate rot, an antiseptic quickly-drying pigment might be beneficial. This and the time of the season for pruning, at which the cut tubes or fibres are least liable to die inward, deserve attention. We consider the spring the least dangerous time. Should a number of small shoots spring out in consequence of this last pruning, they may be swept down if good plank be desired; if not, they may remain, as their presence will not greatly injure the plank, and they occasion the stem to thicken considerably faster where they grow: yet it is probable that, in doing this, by obstructing the flow of the sap downwards, they may interfere with the natural enlargement of the roots, and ultimately be injurious. Some varieties, or rather some individuals of oak, are much more prone to this sprouting upon the bole after pruning than others; where the disposition exists in a great degree it ought to be encouraged, and the tree set apart for the construction of cabinet work.

This system of pruning—encouraging numerous feeders and one leader while the tree is young, and of allowing or rather inducing the branches, after the tree has acquired sufficient height, to spread out into a horizontal top, is in harmony with, and only humouring the natural disposition of trees, and is therefore both seemly and of easy practice *. The perfection of naval forest economy would consist in superadding (according to instructions to be given on training of timbers) a top of which every branch is a valuable bend or knee, though in consequence of the situation the timber will be fragile, and of light porous texture.

In pruning and educating for plank timber, the whole art consists in training the tree as much as possible, and with as little loss of branch as possible, to one leader and numerous feeders, and to the regular cone figure which the pine tribe naturally assumes. This can be best and most easily performed by timely attention—checking every over-luxuriant, overshadowing branch and wayward shoot on its first appearance; so that none of the feeders which spring forth at first may be smothered, till they in turn become lowermost; and by the influence of rather close plantation, which of itself will perform in a natural manner all that we have been teaching by art, and will perform it well. This closeness must, however, be very guardedly employed, and timeously prevented from proceeding too far, otherwise the complete ruin of the forest, by premature decay or winds, may ensue, especially when it consists of pines. Of course all kinds of pines require no other attention than this (well-timed thinning), and to have their sickly moss covered under branches swept clean down.

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* Commencing by times, the greater part of training and pruning for plank, excepting in the case of dead branches, fractures, and last pruning, may be performed by a small knife.

SECTION II. TIMBERS.

TIMBERS, as before stated, are the ribs of the vessel, spreading out and upward (excepting at the bow and stern) at right angles to the keel and keelson, two large straight logs which form a double spinal support or backbone. The ribs or compass timbers in great public building establishments are sometimes bent by machinery, after being softened by steam or hot liquids *; and for this purpose the

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* We are not in possession of sufficient facts to judge of the effect to hasten or deter decay occasioned by the timber having

cleanest, straightest wood is requisite. We, however, do not believe that pieces of great diameter, bent artificially, can have equal strength and resilience as when grown bent—the fibre must in some degree be crippled. We admit that timbers and frames may be built of separate bended pieces of no great thickness, and have all the strength and resilience of natural bend: the strongest and most elastic mode of forming vessels would be to compose them of different layers of plank over each other in diagonal fashion, or at an angle 60°, but the labour and inconveniency of these modes would be great. We will not admit that an experiment between the strength of a piece of coarse cross-grained timber, half naturally bent, half cut out of the solid, and that of a piece of clean timber artificially bent, is any proof on the subject. Let us produce a clean natural bend, exactly fitted to its place, without any section of fibre, and make experiment with it. But at any rate, as this plan (bending of timbers) has never been adopted to any extent in our private building-yards, we must doubt its economy,—either

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been softened in hot liquids of 212° or upwards, and not raised so high as to generate pyrolignous acid; but we think it must impair the elasticity.

that the practice is of no considerable advantage, or that the requisite machinery is too expensive for private establishments, and conclude that fine bent timber still continues a necessary in the formation of at least our mercantile marine.

Of the very ingenious innovations in the structure of vessels contrived by Sir R. Seppings, by which knees and crooked timber might nearly be superseded, we can only say, the practice is not followed, and, at least in private building-yards, not likely to be so; —that the demand for fine crooked timber, comparatively, is, and will continue to be, as great as ever. Should our war navy, from the introduction of steam impulse and bomb cannon, be reduced to fleets of strong gun-boats, the demand for crooked timber, instead of lessening, will greatly increase,—the building of frames of straight timber being more expensive, and less suitable, in small than in large vessels; and should war occur, in the hurry of the formation of a new war navy under a different principle, the speediest and simplest mode of construction will be followed.

Nearly two-thirds of the timbers of a vessel consist of the curves and bends *a, b, c, d, e, f*; the other part is of straighter timber, and easily obtained.

All timbers require to be straight in one way—in the plane of their side, and the sides generally to be square. The under measures embrace timbers of appropriate size for vessels from 50 to 500 tons register; it is seldom that merchantmen are required under or above this size. Of course, large war-vessels require timbers of larger dimension. The corresponding timbers of vessels of different size are nearly similar figures, and the length of their respective lines not far from being in the ratio of the cube root of the tonnage—a little deeper and thicker in the smaller vessels. When timbers are formed of larch or pine, they require to be a little more in diameter than when of oak.

Fig. *a*, Flat floor, from 9½ to 18 feet long (that is, 9½ for a vessel of 50 tons, and 18 for one of 500), and from 9 to 16 inches deep at middle; thickness ¼th less than depth, the diameter increasing in proportion to the length. When fillings such as *s* are used, flat floors are cut from straight logs.

b, Rising floor shorter, and same depth and thickness as former.

c, *c*, High rising floors, from 4 to 8 feet in length of wing, and a little deeper, and same thickness as former. From the difficulty of procuring this bend, the wings are often used of unequal length, according as the timber turns out, the shorter wing to exceed 3 feet, and more when of considerable diameter. Floors are of every rise from *a* to *c*, being flattest at midships, and rising gradually as they approach the bow and stern. In all timbers, it is necessary, for strength, that the fibre of the wood extend from one end to the other without much cross grain. See lines on high rising floor, *c*.

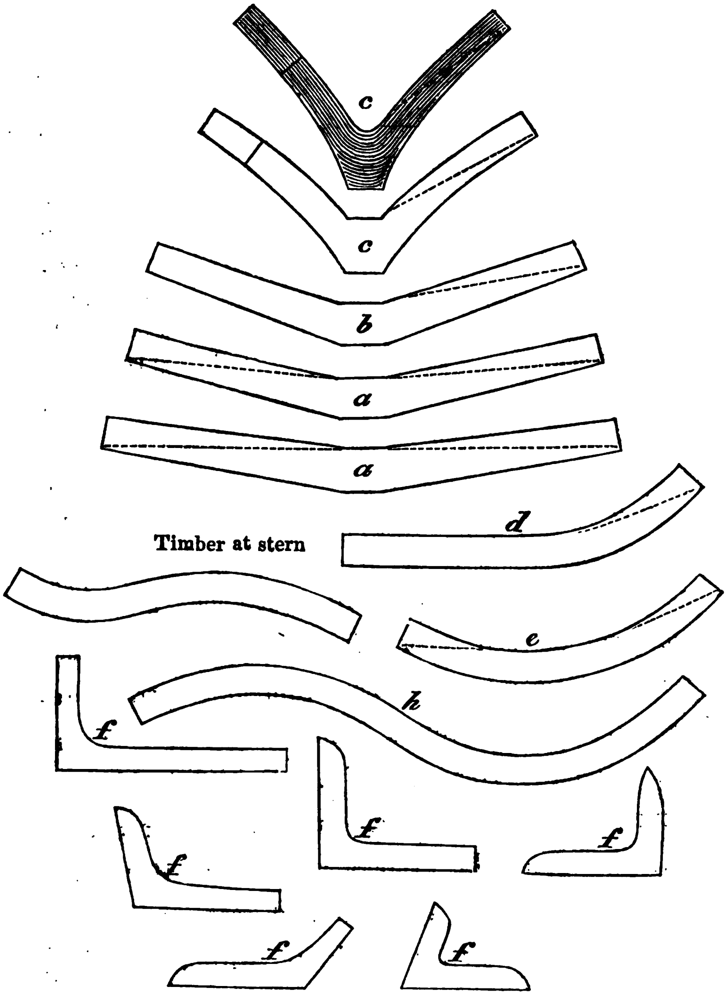
d, First foot-hook, from 7 to 13 feet long, and from 7 to 14 inches deep; thickness ⅕th less than depth.

e, Second foot-hook, from 6 to 10 feet long, and from 6 to 13 inches deep, thickness ⅙th less than depth. This curve, when of great size, is valuable as breast-hooks—curved timbers stretching horizontally under, and at right angles to the bow-timbers, to support the bow.

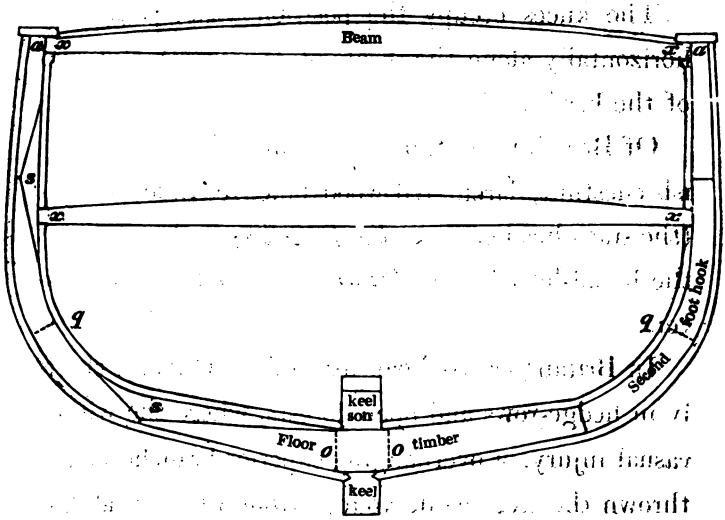
f, *f*, *f*, Knees, the one wing nearly at right angles to the other; from 2 to 9 feet in length of wing; depth at middle as much as possible; thickness from 4 to 12 inches,—generally required about 3½ feet long, and from 6 to 8 inches thick. Knees, when large, suit for high rising floors.

Fig. *h* is a valuable piece, and easily procured by bending the young plant; when cut, it forms two second foot-hooks.

Figs. *a*, *b*, *c*, *d*, *e*, are suitable, though the part cut off by the dotted line be awanting. In good work, this plan is often followed, and a cross-chock put on. (Vid. *s*, left side of the cross-section of a vessel thus timbered, page 20). By this mode of building, vessels can be constructed from much straighter timber, and the vessels are superior, from being more elastic; but from the nicety and expense of the work and waste of timber, the practice is not much in use.



Cross-section of a Vessel at midships—knees not inserted.



A first foot-hook alternates with each floor, and second foot-hook, alongside, extending from *o* to *q*; and a top-timber, or third foot-hook, alternates alongside of each second foot-hook, and chock extending from *q* to *a*. These timbers are bolted together, and constitute a frame or double rib; and the skeleton is composed of a series of double ribs (several inches separate, of course wider above than lower down, as the timbers decrease in thickness), to within a little of the bow and stern, where the timbers are usually placed singly, without framing.

In large vessels a fourth futtock is used; thence straighter timber is suitable.

The knees occupy the position at *x*, stretching horizontally along the inside of the vessel and end of the beams.

Of British trees, timbers are formed of oak, Spanish chestnut, larch, red-wood pine, red-wood willow (the stags-head ozier, *Salix fragilis*), and sometimes the broad-leafed elm (*Ulmus montana*) under water.

In Britain, crooked oak for timbers is found chiefly in hedge-rows and open forests, where the winds, casual injury, or overhanging superior branches, have thrown the tree, while young, from its natural balance; or, by the tree, from open situation, or excision of lower branches, parting early into several leaders, which, in receding from each other, form curves and angular bends. On the Continent of Europe, in the natural forest, it is chiefly the tops of old lofty trees which afford the crooks; in consequence, those we import are, for the most part, of a free, light, insufficient quality *.

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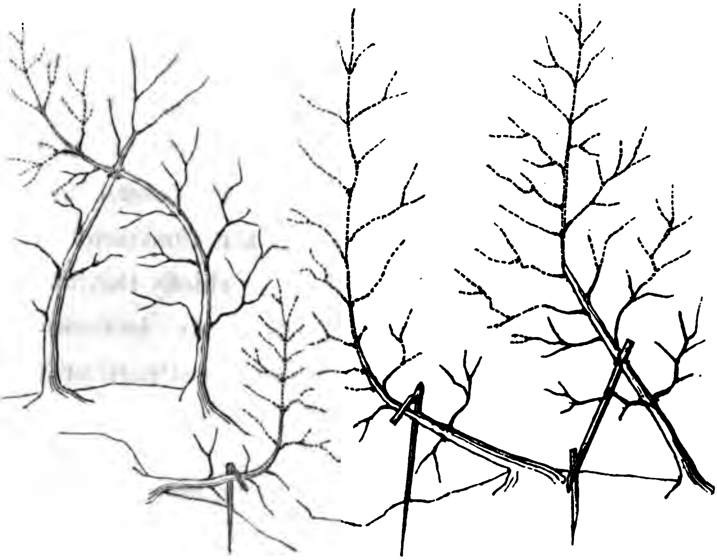
* As excellent plank can be obtained by importation, the grower of naval timber ought to regard the production of crooks as a more patriotic occupation than the production of plank. *It will generally pay better.*

To procure a sufficiency of excellent crooks, every person who has the charge of young plantations of timber intended for naval purposes, ought, in the more exposed situations not favourable to the growth of plank timber, or timber for bending, when the plants are from 3 to 15 feet high, to mark out the most healthy, suitably formed plants, sufficiently close to fill the ground when of the proper size, say 6 yards apart, and to bend these, as the under figures will illustrate. The dotted portion is the growth after being bent.



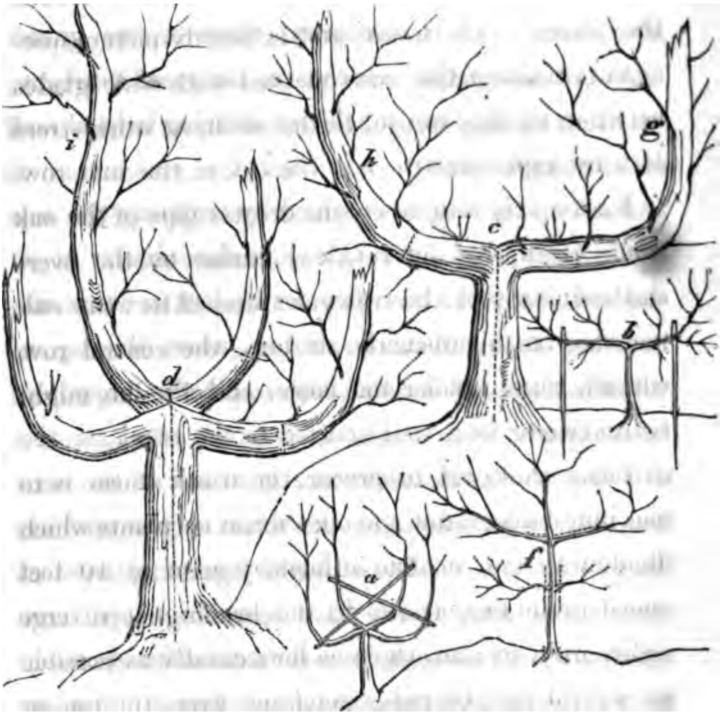
The bend of floors requiring to be at the middle, and of angular bend, see Fig. *f*, young trees of one-half the required length, should have the earth removed from the bulb of the root, from one or both sides, according to circumstances, and the tree and stool partially upset to windward, that is, generally south-west; (the operator, in effecting this, may be assisted by a strong pronged instrument); then fixed in this inclined position, and the earth filled in. This inclination may be given at planting, when the plants are tall.

The best mode of securing the larger plants in their bent position, is by rods, forked or hooked at one end, the other end nailed to a ground-stake;—the upper end, if forked, firmly tied to the bent plant by mat or straw rope. Smaller plants may be secured to the notched tops of stakes by ligatures; and the smallest, particularly larch, pinned down by small stakes with hooked tops. Advantage may also be taken of an adjacent tree of small value, and which would ultimately be required to be thinned out, to tie the bended standard down to the most convenient part of its top or stem, lopping off all above the ligature, if it interfere with the standard, and barking it near the ground, to prevent much future growth When the workmen comprehend the required bends, they will fall upon methods of fixing the plants in the most suitable position, better adapted to the locality than any directions can teach. The plants will require to be fixed down at least two years, and bent a little more than what is requisite, as in their after-growth they have generally a tendency to become straighter, from depositing the thickest layers in the hollow of the bend. A fine regular curve may be obtained by bending the plant for several successive years, a little lower every year; this gradual lowering does not so much check the growth of the leader, nor tend so much to cause the feeders upon the upper side to push as leaders. When oaks are bent, great attention must be paid to cut away any ground-shoots, and to cut off or twist down any strong feeders that stand perpendicular on the upper side of the tree; and also for several years afterwards, to look over the trees twice a-year, correcting any exuberant feeder, and destroying root-shoots. The forester ought to keep in mind that his pupils are proverbially pliant, and that, should his growing timber not be of the most valuable and most appropriate figure, he must rank either with the negligent or the incapable.

Ship timbers being generally required of greater depth than thickness, that is, broadest in the plane of the curve, hedge-row is better adapted to growing them than the forest, especially when the trees are close in the row. The bend generally takes place across the row; and the bole of the tree acquires a greater diameter in that direction than in the line of the row. If the figure of the top of a tree be very elliptical in the horizontal plane, the cross section of the bole, instead of being circular, will also be elliptical (cake-grown). The lateral spread of the roots in thick planted rows being greater than the longitudinal, also tends to give elliptic bole, the stem swelling most on the sides where the strongest roots enter, which, of course, always occurs on the sides affording most nourishment. Forests intended for ship timbers might be planted and kept in rows a considerable distance apart, with the plants close in the row, and thus acquire the elliptic bole. This would also facilitate the bending; by being turned a little right and left alternately, they would spontaneously, from the weight of the top, and their inclination to avoid the shade of each other, increase the original bias. Were forests planted in close double rows, the plants thick in the row, with wide avenues or glades between, many of the trees would acquire crooked boles, and the crooked might be retained when thinning. Avenues of this description would form agreeable diversity from the monotonous irregularity of the forest, and be highly picturesque.

Were close triple rows planted with wide glades between, having spruce, larch, birch, or other trees of more rapid growth than the oak in the mid row, and oak in the side rows, the greater part of the oak would be thrown out into fine curves by the overshadowing top of the superior tree. After the oak had received a sufficient side bias, the central row, which of those kinds comes soon to be of value, might be removed.

The easiest way to procure good oak knees is to look out in hedge-row and open forest for plants which divide into two or four leaders, from 5 to 10 feet above ground; and should the leaders not diverge sufficiently, to train them as horizontally as possible for several feet, by rods stretching across the top, or by fixing them down by stakes; see following figures. Figs. *a*, *b*, *f*, are drawn to a smaller scale than *c*, *d*; of course, a stem, after dividing, never extends in length below the division.



When grown, the main stem, either used whole, sawn in two, or quartered, will form one wing of the knee, and the bent branch the other; see figs. *c*, *d*. The dotted lines shew the saw section. Particular attention must be paid to prevent oaks from separating into more than four leaders, and also to train up these leaders a considerable height, without allowing them to divide again, retaining always numerous feeders; thus, when the tree acquires size, many valuable crooks *g*, *h*, *i*, will be formed above the knees. It is necessary, however, to guard against training the branches to too great a height; as, when so, they run much risk of being twisted and torn by high winds.

Knees may also be obtained by cropping the top of plants that have side branches similar to *f*, and training these branches for leaders as above directed. In this case, the section, where the top is cut off, must not be too large, and the branches, either two or four, well knotted to the trunk, or the situation sheltered, otherwise the trunk at the section may be split down by the strain of the wind on the new leaders. Also, in healthy growing trees of considerable size, which have spreading tops, and which are not to be cut down for a considerable time, the forester, if he have a good eye, may, by lopping off a few branches here and there throughout the top, throw the greater part of the boughs into condition to become knees, or valuable crooks, when of size. This is of most material consequence to the ultimate value of half-grown oak trees, in open situations, and ought to be particularly studied by the superintendent, as, when allowed to run into very numerous *stemmy* branches, without direction or curtailment, the top, instead of being ultimately of considerable value as timber, is of none. Directions in writing will scarcely suffice to teach a forester this part of his business; he must consider attentively the knee figures and bends we have furnished, fix them in his memory, and use every eligible means to obtain them. Knees, of all descriptions of oak timber are in the greatest request. We have known them purchased at 7s. per computed solid foot, which, from the plan of measuring, is as much as 10s. per real solid foot. The prevailing inattention to judicious training will continue to occasion the supply of knees to be short of the demand, and thence the price high, provided some change does not take place in the structure of vessels, or iron knees be adopted, which are now sometimes used, or vessels, with the exception of the deck and rigging, be formed of iron altogether, which we have seen do very well in inland navigation.

As crooked round oak timber of the natural length is extremely unmanageable, and its distant transport very expensive, it is desirable that it be squared and cut in lengths suited to its ultimate use, where grown. This requires a thorough knowledge of the necessary curves, to which the figs. p. 19, will afford considerable assistance. However, the superintendent of any extensive fall of naval timber either should be a shipwright who has had practice in lining off timbers, or should have passed several months in a dockyard during the timbering of vessels, observing every piece that is put to use.

As most part of the timbers of a vessel have their sides squared, the cutter cannot err much in hewing away the sides in the plane of, and at right angles to, the curves, at least as deep as the sap-wood reaches, thus leaving only a little sap-wood on the angles; the sap-wood, in all cases (except in those small craft used in carrying lime, which preserves from rot), being worse than useless; by its decay not only weakening the vessel from the want of entireness of the timbers, but also acting as a ferment to further corruption.

In our directions for obtaining curved and angular bent timbers, we may be thought to have been a little too minute with the dimensions and figures: under the hand of the shipwright, or person of skill, a tree of almost any possible bend cuts out to valuable purpose: what is wanted is crooked timber, free of large knots;—first and second foot-hooks and knees are, however, most in demand.

PART II.

BRITISH FOREST TREES USED AS NAVAL TIMBER.

Oak—*Quercus*.

Oak appears to be the most prevalent tree about the middle of the north temperate zone, growing, naturally, upon almost every soil, excepting some of the sterile sandy flats. With the exception of the pines, it is by far the most useful kind of tree, almost balancing the accommodating figure of stem, and manageable quality of the pine timber, by its greater strength and durability, and excelling the pines in value of bark. It is not easy to determine whether there be distinct British species in the genus *Quercus*; but, at least, there are several breeds, or families, or grouped resemblances, which, though the individuals may slightly vary, and though a gradation, or connection, may be traced among these families themselves, yet possess general character sufficiently marked to support names. Botanists, who are so prompt and so well prepared with their classes, orders, genera, species, varieties, long before they acquire much knowledge of what they are so ready to classify, or be able to distinguish between species and variety, or know if species and variety be really distinct, divide the oak of this country into two species, *Quercus Robur* and *Q. sessiliflora*, the former with long fruit-stalks, and hard, strong, durable timber; the late leafing old kind once so prevalent in the island: the latter an earlier leafing, faster growing kind, timber inferior, leaves petiolate, fruit sessile, not common, but supposed native. We consider there is no foundation for this specific distinction; we have met with oaks with various lengths of fruit-stalks: Besides, short and long fruit-stalks is a very common difference among seedling varieties. The families or breeds which we have observed in the indigenous oak resemble what are found among almost every kind of vegetable, and graduate into each other,—those farthest removed in appearance, no doubt having power to commix by the pollen. The most remarkable distinction we have observed is in the colour of the bark, whether inclining to white or black. The variety or breed with grey white bark, often very smooth and shining, and sometimes beautifully clouded with green, has also a different form of leaf and figure of top from those with blackish bark, and we have no doubt will also afford a different quality of timber. Those with blackish dingy bark vary considerably from each other, some being of very luxuriant growth and heavy foliage, with thick fleshy bark, affording much tannin; others, though in favourable situation, of stunted growth, thin dry bark, and delicate constitution, often being nipped in the twigs by the frost: some having a round easy figure of top, even with pendulous branching; others extremely stiff and angular in the branching; some with the most elegant foliage, deeply sinuated and finely waved, others with the clumsiest, almost misshapen foliage, almost as if opposite principles had presided at their forming. We have observed the earlier kinds, with the dark bark, to have generally the easiest figure of top; the angular branching and stiffness of figure of top being greatest in those sooty-barked late kinds, most disposed to take two growths in the season, the spring and autumnal, which, from the proneness of these kinds to be affected in the terminal bud by monstrosities, and sometimes also to be nipped in the point of the unripened autumn shoot by the frost, are generally thrown out in different directions, the tree, from these causes, growing awkwardly and irregularly, and by fits and starts.

Besides the indigenous *Quercus Robur*, we have a number of kinds, termed distinct species, growing in Britain, of foreign derivation—the Turkish oak, *Quercus Cerris*; the Lucombe oak, *Q. sempervirens*; the scarlet-leaved American, *Q. coccinea*; the evergreen, *Q. Ilex*, and several others. The Turkish and Lucombe resemble each other; but the latter generally continues green till the spring, when the old leaves wither, a little before the young appear: Botanists make them varieties. We consider the Turkish oak the most valuable and elegant of these foreign kinds. The leaves are generally very long and slender, deeply and widely sinuated, and the teeth or salient angles sometimes undulated, having a curled appearance; yet there are some individuals with broad, short, flat leaves, not differing in figure from those of the common oak, but the tree in other respects not different from the Turkish, being easily distinguished from the common oak by the reddish hairy appearance of the developing shoot, the scales of the bud having a hair-like extension, visible in each leaf axilla. The acorns are also bristled like echini, with this scaly prolongation. The timber is tough and clean, resembling the white American, and suitable for staves. The stem and branches are generally very straight, as the terminal bud seldom fails, and the growing proceeds steadily, without much autumnal shoot.

As oaks run more hazard in transplanting than most other kinds of trees, the greater care is necessary in procuring well-rooted, short, vigorous plants; in having the soil free of stagnating water, in timing and executing the work in a proper manner, and in hoeing around the plant, keeping the ground clean and friable on the surface during the first two or three seasons. As young oaks grow much more vigorously under considerable closeness and shelter, and as the plants are expensive, it is proper to plant, along with them, a mixture of cheaper plants, larches or other pines, which also sooner come to be of a little value, to be removed gradually as the young wood thickens up. In bleak exposed situations, it is well to plant the ground first with pines, and when these attain a height of 6 or 8 feet, to cut out a number, not in lines, but irregularly, and plant the oaks in their stead, gradually pruning and thinning away the remaining firs as the oaks rise. In general, pitting is preferable to slitting; but when the plants are very small, and the ground wet-bottomed (with close subsoil), liable to become *honeycomby* with frost, slitting secures the plant better from being thrown out.

Oak is by far the best adapted tree for hedge-row, or for being grown by the sides of arable fields, both with respect to its own qualities, and to the growth of the adjacent crops or hedge. The bark is much thicker, and more valuable in proportion to its bulk here, than in close forest, and the timber more crooked, which is desiderated in oak, but which unfits most other trees for much else than firewood. The oak is, besides, as generally suited for the variety of soils which lines crossing a country in all directions must embrace: this is matter of consideration, as few planters have skill to locate a number of kinds properly. It will also be thought, by reason of British feeling, the most interesting and ornamental; nor is it to be overlooked, that, by the roots taking a more downward direction than other trees, the plough has greater liberty to proceed around, and the moisture and pabulum necessary to evaporation and growth are not drawn from the ground so superficially; thence the minor plants adjacent do not suffer so much. We have observed, too, that, when all cause of injury by root suction was cut off by a deep ditch, the undergrowth seemed less injured by shade of oak than of some other trees. The apple and the pear only, appear to be as little detrimental to the surrounding crop as the oak. The ash, the elm, the beech, in Scotland the most general hedge-row trees, are the most improperly located; the ash and the elm as being the most pernicious to the crops, and the beech as being of little or no value grown in hedge-row. In clays, most kinds of trees, particularly those whose roots spread superficially, are more detrimental to the crop around than in the more friable earths, owing to the roots in clays foraging at less depth, and to the clay being a worse conductor of moisture than other earths. The disadvantages attending the planting of hedge-row with oaks are, that their removal is not in general so successful as that of other trees, especially to this exposed dry situation, and that the progress of the plant, for a number of years, is but slow; and thus for a longer time liable to injury from cattle. Fair success may, however, be commanded, by previously preparing the roots, should the plants be of good size; transplanting them when the ground is neither too moist nor too dry, and in autumn, as soon as the leaves have dropped or become brown, particularly in dry ground; performing the operation with the utmost care not to fracture the roots, and to retain a considerable ball; opening pits of considerable size for their reception, much deeper than the roots, and should a little water lurk in the bottom of the pit, it will be highly beneficial, provided none stagnâte so high as the roots; firming the earth well around the roots after it is carefully shaken in among the fibres; and, especially, keeping the surface of the ground, within four feet of the plant, friable and free from weeds, by repeated hoeings during the first two or three summers. Of course, if you suffer the plant to waver with the wind, or to be rubbed and bruised by cattle, or by the appendages of the plough, it is folly to expect success. On this account, stout plants, from 8 to 12 feet high, the branches more out of the way of injury, may, in sheltered situations, under careful management, be the most proper size. Much also depends on procuring sturdy plants from exposed situations. We have experienced better success with hardy plants from the exposed side of a hill, having unfibred *carrot* roots much injured by removal, than with others from a sheltered morass, having the most numerously fibred, well extricated roots. In cases, where, from the moistness and coldness of the ground in early summer, there was a torpor of root suction, and, in consequence, the developing leaves withering up under an arid atmosphere, we have attempted to stimulate the root action by application of warm water, covering up the surface of the ground with dry litter to confine the heat; we have also endeavoured to encourage the root action by increasing the temperature of cold light-coloured soils, by strewing soot on the surface for a yard or two around the plant, and by nearly covering a like distance by pieces of black trap rock, from three to six inches in diameter. The success from the pieces of trap appeared greatest; they diminished the evaporation from the ground, thence less loss of heat and of necessary moisture; and being at once very receptive of radiant caloric, and a good conductor, they quickly raised the temperature of the soil in the first half of the summer, when bodies, from the increasing power of the sun, are receiving much more heat by radiation than they are giving out by radiation.

The oak should never be pruned severely, and this rule should be particularly observed when the tree is young. We have known several of the most intelligent gardener-foresters in Scotland err greatly in this; and, by exclusively pruning the oak plants, from misdirected care, throw them far behind the other kinds of timber with which they were mixed in planting. There is no other broad-leaved tree which we have seen suffer so much injury in its growth, by severe pruning, as the oak. The cause of this may be something of nervous susceptibility, or connected life, all the parts participating when one is injured; it may be owing to the tendency to putrescency of the sap-wood, or rather of the sap, the part around the section often decaying, especially when the plant is not vigorous; or it may arise from some torpor or restricted connection of the roots, which, when robbed of their affiliated branch, do not readily forage or give their foraging to the support of the nearest remaining branch, or to the general top of the tree, but throw out a brush of twigs near the section.

Although the oak often lingers in the growth while young, yet, after it attains to six inches or a foot in diameter, its progress is generally faster than most other kinds of hard wood, not appearing to suffer so much as others from excessive fruit-bearing. The value of the timber, and also of the bark, and the slight comparative injury occasioned to the under crop, whether of copse, grass, corn, or roots, independently of any patriotic motives, or religious reverence lingering in our sensorium from the time of the Druids, should give a preference to this tree for planting, wherever the soil and climate are suitable, over every other kind, with the exception of larch and willow, which, in particular soils, will pay better.

The planter of oak should throw in a considerable proportion of Turkish oak into the more favourable soils and situations. The beautiful clustered, fretted foliage of this species gives a richness, and, in winter, when it retains the withered leaf, a warmth of colouring to our young plantations beyond any other of our hardy trees and shrubs. We have had this kind, eighteen years old, equal in size to larches of the same age in the same ground. We cut down several of these oaks of about 8 inches in diameter, and compared the timber and bark with those of common oak of the same age. The timber was clean, very tough and flexible, with much *flash*, and we should suppose might suit for plank when matured; at any rate, from the splendid shew of the laminæ (*flash*), it would form beautiful pannelling and furniture. It shrunk, however, extremely while drying, which must have been partly owing to the quick growing and youngness, it thence consisting almost entirely of sap-wood, and this sap-wood almost entirely of sap; and, when left in the sun in the round state, after peeling, rent nearly to splinters,—much more than the common oak under the same exposure. The bark was about double the thickness and weight of that of the common oak of equal size, and, in proportion to its weight, consisted much more of that cellular or granular substance most productive of tannin. The varieties of common oak with thick bark are generally of inferior quality of timber; but they are by far the finest, most luxuriant growing trees, with rich heavy foliage, and appear as giants standing in the same row with the thin barked varieties, though planted at the same time.

To the naturalist the oak is an object of peculiar interest, from the curious phenomena connected with the economy of numerous insects who depend upon it for existence. It would be tedious to describe the different apples, galls, excrescences, tufts, and other monstrosities which appear upon the oak. It is something like enchantment! These insects, merely by a puncture and the deposition of an egg, or drop of fluid, turning Nature from her law, and compelling the Genius of the Oak to construct of living organized oak matter, instead of leaves and twigs, fairy domes and temples, in which their embryo young may lie for a time enshrined.

SPANISH CHESTNUT—*Castanea vulgaris*, (*Fagus Castanea, L.*)

SPANISH or sweet Chestnut, sometimes named Chestnut Oak, sometimes included in the genus Fagus, seems at least a connecting link between Quercus and Fagus. This valuable timber tree, the largest growing, and, in many places, also the most common in the south of Europe, and which was once so abundant in England that many of the largest of our ancient piles are wooded of it, has been for several ages much on the decrease in this country; owing, probably, to a slight refrigeration of climate, which, during this period, appears to have taken place, preventing the ripening of the seed, or, in more rigorous winters, following damp, cold summers, destroying all the young plants (at least the part above ground), whose succulent unripened shoots and more delicate general constitution, from immatured annual round of life, or imperfect concoction of juices, have not power to withstand the severe cold sometimes occurring near the surface of the earth. A very general destruction of the young plants of this kind of tree has occurred more than once within our memory from severe frost; but as the climate, a few years back, rather improved, and the spirit of planting became more general, a considerable number of plants of this tree have attained height and hardihood to withstand the cold, excepting in the points of the annual shoot, which we notice are again nipped (year 1830). This may give encouragement to more extended planting, as the tree is handsome, and, in most places, where water does not abound nor stagnate, acquires great size in comparatively short time. It is said to prefer a gravelly or stone rubble subsoil, but we have seen it in rich clay, in row with large beeches, even exceed them in size: We should prefer for it any deep friable dry soil.

There is one circumstance connected with this timber in this country, at least in Scotland, which must prevent its general use in ship plank, and be of material injury to it for ship timbers; this is, that few trees of it of size are found without the timber being shaky or split, some to such a degree that the annual rings or concentric growths have separated from each other. This appears to be owing to our climate being colder than what is suitable to the nature of the plant: the sap in the stem possibly freezing in severe weather and splitting, or severing the growths of the timber, but more probably occasioned by the season being too short, and too moist and cold, to ripen or fill up with dense matter, sufficiently, the frame of the annual growths; thence, as each ring of sap-wood, prematurely hastened by the torpor of moisture and cold, turns to red or matured wood, and, in so doing, dries considerably within the other rings of moist sap-wood, the contractile force may be sufficient to separate this growth from the next external sap growth, the cohesion existing between the tissue or fabric of the growth being much stronger than the cohesion between one growth and another. The uncommon dryness of the matured wood, and moistness of the sap-wood of this tree, and smallness of the number of sap-wood rings, commonly only from 2 to 6 in this country, incline us to believe that this is the cause of the insufficiency or defect; and that, in a milder, drier climate, the sap-wood rings will be found to be more numerous, and thus, independent of a better first ripening, affording a longer time for their cells to be more filled up with an unctuous matter (which prevents the shrinking) gradually deposited while they convey the sap, the sap-wood rings being the part of the timber through which the sap circulates. As proof of this unctuous deposit or filling up, we observe that dry sap-wood imbibes moisture much quicker, and in greater quantity, than dry mature. We think this premature maturity (if we may so term it) of timber in cold countries, a general law. Our larch, originally from the Apennine, has not more than one-third of the number of sap-rings of our Scots fir, indigenous in Mar and Rannoch mountains; and our narrow-leafed, or English elm, said to have been introduced from the Holy Land in time of the Crusades, has not more than one-half of the number of our indigenous broad-leafed, or Scots elm. From the sap-growths of Laburnum, scarcely exceeding in number those of the Spanish chestnut, we should suppose that it has been moved northward, or that the proper climate has left it. We have observed that moist, or water-soaked ground, has influence, as well as climate, to deprive the alburnum vessels sooner of their living functions; inducing that torpor of tubes, or semi-vital condition, in which they only serve to support the more active parts, and constitute what is called Mature Timber.

It is a general opinion that Spanish chestnut soon takes rot in situations where the roots come in contact with water. This appears to result from moist soil inducing the too early maturing of the timber already alluded to, and occasioning shaky insufficient fabric, which soon corrupts. We have observed oaks which had fewer layers of sap-wood, from growing in damp situations, have the timber of inferior quality, and sometimes of a shaky, brownish description, when cut across, throwing out a dirty brownish liquid or stain.

From the use of the Spanish chestnut in the Spanish navy, both in planking and timbering, and from the roofing beams and ornamental work of Westminster Hall being also of this wood, we should suppose it was not so liable to this defect of rents in the timber in milder climates. Chestnut timber is a good deal similar to oak, though not quite so reedy and elastic, but is destitute of the large laminæ or plates (*flash*), which, radiating from the pith to the outside, become so prominent to view in the oak when the longitudinal section is perpendicular to the outside, in the plane of the laminæ. It is, we should think, as capable of supporting weight, when stretching as a beam, as the oak, and is equally, if not more durable, many beams of it existing in very old buildings undecayed: it is said even to have been taken out fresh where it had stood 600 years as lintels. Earth stakes of it are also very durable. It possesses one advantage over oak, which must recommend it for ship-building, that is, having much less proportion of sap-wood; and, from the matured wood containing much less sap or moisture, we should suppose it not so liable to dry rot, or that more simple means, or shorter period, would suffice for seasoning it, so as to be proof against this evil. Spanish chestnut is as yet little known among British shipwrights; but were a quantity of it in the market free of the unsoundness we have alluded to, its merits would soon become known. The bark is used by tanners, but is said not to equal that of oak.

Beech-Tree—*Fagus sylvatica*.

This hardy tree occupies fully as wide a range, both of soil and climate, as the oak, and is generally the fastest growing, most vigorous of all our hard-wood kinds, prospering on all soils, on the dry and moist, the aluminous, the calcareous, the siliceous, provided water does not stagnate. It combines magnificence with beauty, being at once the Hercules and Adonis of our Sylva. The timber of our beech, while green, is by far the hardest of our large growing trees, and, in the American forest, the members of the beechen family match better than those of any other, with the perseverance of the ruthless Yankee; the roots retaining the hardness deeper in the earth than those of any other tree, and being so plaited and netted throughout the ground for a considerable space around the bulb, that it is next to impossible to trench or dig over the soil till they have decayed.

As we have before stated, the timber of the beech-tree soon corrupts if it is not speedily dried, or kept in water after being cut down, and is equally liable to corruption in the tree when deprived of life by wounds or other injury. Beech has a matured and sap wood, although they are not very distinguishable, being nearly of one colour. The former has considerable durability when kept dry, the latter is speedily consumed by worming.

The planter of beech should procure the kind* with yellow-coloured wood, termed by joiners Yellow Beech, in opposition to the kind with white wood, called White Beech. The yellow grows faster and straighter, and is cleaner and freer of black knots, and also more pleasantly worked than the white, but it corrupts much sooner in the bark when cut down. This variety of beech, when properly trained, is probably the most profitable hard-wood that we can raise; when planked, it bends pleasantly under the shipwright to the curvature of the vessel's side. The tree is also much superior in size and grace of outline to the white. There are few planters who need be put in mind that beech of small size, or of short or crooked stem, is the least valuable of all timber. Whoever plants with a view to profit will, therefore, throw in only as many beech plants as may ultimately be required for standards, and these in the bosom of plantations; as it is seldom that beech attains to much value in hedge-row or on the outskirts of woods, from its proneness when so situated to ramify and grow crooked. It is, however, quite possible, with a little early attention, to rear beech as straight and clean as to be valuable, on the outskirts, where it forms a beautiful fringe to the plantation, and affords excellent shelter.

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* We have often preferred the terms kind, breed, family, individual, to genus, species, variety, subvariety, as the former seem less definite. Were nature true to the latter classification as employed by botanists, it would be convenient.

ELM—*Ulmus*.—BROAD-LEAVED, OR SCOTCH, OR WYCH ELM—*Ulmus montana*.

This beautiful and most graceful tree, whose favourite locality is the damp, deep, accumulated soil, free of stagnant water, at the bottom of declivities, is, together with its sister, the small-leaved kind, the English elm, when so situated, the fastest growing of our hard-wood trees. Both delight in easy or gravelly soils, though the small-leaved will also prosper in the more adhesive, the alluvial and diluvial clays.

There are a number of kinds of elm growing in this country, differing rather more from the common run of *U. montana* and *U. campestris*, than what occurs among seedling varieties of untamed plants; but as these have very probably a power of mingling by the pollen, thence not specifically different, we leave to botanists to explain their nice peculiarities, and think it sufficient to rank the whole under *montana* and *campestris*, especially as the timber seems to range into two kinds—*Montana*, with large leaves, heavy annual shoots, somewhat zig-zag, thick towards the point, thence drooping a little from gravity; having much sap-wood, and timber of great longitudinal toughness, but, from the great quantity of sap-wood, and want of lateral adhesion, it splits considerably in drying;—*Campestris*, with smaller leaves, more numerous straight annual shoots, which are small towards the point, thence more erect, has but little sap-wood, and the timber also possessing greater lateral adhesion, and less longitudinal, it does not crack much in drying. We have noticed one broad-leaved kind or variety, whose annual twigs often spring out in tufts or knots from one point; this seems to arise from the shoot of the preceding year sometimes dying, probably nipped by frost, and the tuft of shoots springing out from the knot at the lower extremity of the dead twig. From this cause, it has not the graceful easy spread of branches of the *U. montana*, but assumes a more angular, stiff, upright figure. We have heard this named Dutch Elm, but it does not quite correspond with the elm in the parks at London said to be Dutch. We consider it a kind not very nearly allied to *U. montana*, yet the above peculiarity of appearance may only arise from individual tenderness, and may not be accompanied by other difference of character.

The elm, more especially the broad-leaved Scotch elm, has a peculiar fan-like sloping-to-one-side spread of branches, most perceptible while young; hence the tree when grown up, has generally a slight bending in the stem, which renders it very fitting for floor-timbers of vessels, the only part of a ship, excepting bottom plank, to which it is applicable, as it soon decays above water. Its great toughness and strength, however, render it good floors.

There are some kinds of foreign elm which deserve attention. Some time ago we planted several of these, and lately cut down one of about six inches diameter, which we found a great deal harder and stronger timber than our *U. montana*. We had this kind under the name of the Broad-leaved American. The bark was rather lighter in colour, and smoother, than *U. montana ;* the leaves were rough and large, and the annual shoots extremely luxuriant; but, probably owing to climate, or difference of circumstance, the exposed situation where we had it growing being very unlike the close American forest, it did not carry up its vigour of growing into the top, although the top was healthy, but continued throwing out numerous annual shoots, five or six feet long, from the bulb and side of stem, which disposition we did not succeed in correcting by pruning. This did not seem to arise from grafting, as some of the shoots broke out higher up than the graft must have been, and there was no difference between the lower and upper shoots.

U. montana, when come to some size, on the primary branches being lopped off, like the oak, often throws out a brush of twigs from the stem, and these twigs impeding the transit of the sap, the brush increases, and the stem thickens considerably, in consequence of a warty-like deposit of wood forming at the root of the twigs. This excrescence, when of size, after being carefully seasoned in some cool moist place, such as the north re-entering angle of a building, exposed to the dripping from the roof, forms a richer veneer for cabinet-work than any other timber. This disposition to form brush and excrescence might be given by art to almost any kind of tree, excepting the coniferæ and beech, and might be made a source of considerable profit. This could easily be effected by slitting, pricking, and bruising the bark at certain periods of the season. A very beautiful waved timber might also be formed by twisting the stems of trees tight up with round ropes, the screw circles of the rope not being quite close to each other; the ropes to remain several seasons, then to be kept off for a season or two, and again applied. The practice of forming warty excrescences might be combined with that of forming wavy fibres, with the finest effect. Of course, those trees with timber of rich colour, and susceptible of high polish, would be the most suitable for undergoing this process. *U. campestris* also throws out a brush, but from the great inferiority of the timber in beauty, and from its unfitness for cabinet-work, it would be useless to encourage it by art. Some plants of *montana*, not covered with brush, have a curious unevenness (laced appearance) of the timber in the stem, which renders it a beautiful cabinet plank.

NARROW-LEAVED OR ENGLISH ELM—*Ulmus campestris.*

There are few Scotchmen, as they migrate southward, who have failed to remark the tame subdued appearance of the landscape of the middle and south of England, where a number of straggling tufted-headed poles, along with windmill towers, occupy the horizon. These straggling, tall, tufted poles, stuck in, perpendicular to the flat surface, are composed of living narrow-leaved elm-trees, which the perseverance of the peasantry in quest of billets, has reduced to this condition. Some varieties of this elm, however, when uncurtailed in lateral expansion, attain the grandest development, stretching forth a hundred giant arms aloft, supporting masses of foliage, fantastically magnificent.

In the neighbourhood of London, this tree is attacked by an insect, which, running along the outside of the timber, within the bark, in a few seasons deprives the individual of life, the bark peeling off in large girdles, threatening to bereave this capital of the finest ornaments of its parks. We have observed, in different kinds of growing trees, such as the apple and oak, the roads of insects traversing between the rhind and wood, although the individual thus affected appeared to suffer little or no injury; and we consider the agency of the insect in the destruction of the English elm around London to be merely sequent to disease—perhaps a taint of corruption, or slight putrescency of the sap, occasioned by the *impurities of the London air*, assisted by the hard beaten state of the ground * above the roots. Should any one examine the inside of the bark of a cut tree, when corruption has just begun with the bark, and see how thoroughly it is undermined by insects, he will, we think, admit the strong probability, that the insect is only subordinate in the destruction of those fine old elms around London. We do not wonder at the condition of the trees—it would not surprise us if the human race in London were swept off by some similar secondary cause.

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* In those we observed, we considered this last circumstance had a considerable share as a predisposing cause of the attack of

The small-leaved elm has great disposition to spread by suckers from the roots, and thus extended has become very prevalent throughout most parts of England, in the broad wastes (termed fences), which, from the indolent husbandry, consequent to tithes and the want of leases, generally surround the pasture and corn fields, but which are so necessary to these unvaried plains, as some prominent object, or characteristic land-mark, on which the *amor patriæ* of the population may perch; the finest remembrances and associations of youth being mixed up with these bushy flower-covered enclosures.

It is with country as with society, strong lasting

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the worm. Forests of *Pinus sylvestris* are sometimes destroyed by insects under the bark, in cases where it is difficult to decide whether external circumstances, such as a dry warm season, has been promotive of the increase of the insect itself, or has induced some disorder in the plant, rendering the juices more suitable aliment to the worm.

attachment occurs only where there is individuality of character to give distinctness of image.

> "Oh! how should I my true love know,
> From any other one?"

There is design and utility in this fascination of peculiarity. If individual distinction be but strongly marked, it signifies little of what character. Love of country often hangs upon features of the harshest and most fearful description, with which the associations and feelings become entwisted, as attachment to individual is often rivetted by fierce, austere, or even morose qualities.

The narrow-leaved elm is valuable for forming the blocks and dead-eyes *, and other wooden furniture of rigging, being particularly suitable for these purposes, from its hard and adhesive nature, and indisposition to crack or split, when exposed to sun and weather.

We have observed many minor distinctions, perhaps individual, in the above kinds of elm, in figure, size and smoothness of leaf, in colour and roughness

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* Some nautical or technical terms have unavoidably crept into this work; we shall not presume to think any explanation necessary: Britannia would blush *jusqu'au blanc des yeux*, to the *tips* of the fingers and toes, did she think it were doubted that any of her sons, not doomed to unceasing mechanical labour, were unacquainted with these.

of bark, &c. Some varieties or individuals of the English elm have the bark of the young twigs and branches covered with corky ridges: others want this excrescence.

REDWOOD WILLOW, or STAG'S HEAD OZIER,—*Salix fragilis* *.

THIS kind of willow, once very common in the alluvial parts of Scotland, before the introduction of *Salix alba*, *S. Russelliana*, &c., is probably the most profitable timber that can be planted in such soils. It was our district's maxim, that "the willow will purchase the horse before any other timber purchase the saddle," on account of its very quick growth, and the value of its timber. It delights in the rich easy clay by the sides of our *pows* (the old Scottish term for those sluggish natural drains of our alluvial districts), throwing out its fibril roots in matted-like abundance under the water: it also flourishes in the more sandy and gravelly alluvion, by the sides of rivers and streams, which does not become too dry in summer.

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* It is termed by our professors *Salix fragilis*, or Crack Willow, from the small branches breaking easily at the junction of the annual growth—or, perhaps, Crack Willow, from the branches breaking with considerable report; or from the wood, while burning, frequently detonating or crackling, from the expansion of some aërial fluid within the fibres. Though named by their sapience *fragilis*, it is not weaker than other large growing willows, but stronger and denser; and, being harder in the small branches, they do not bend, but break when their bark and alburnum is driest, in winter. The timber is superior to that of *Salix alba*, or of any other large growing willow we are acquainted with, and is sufficiently pliant and tough.

This tree, similar to some others which, like it, are continued by cuttings or layers, is, in certain seasons, especially when of considerable size, subject to a derangement in the sap-concoction, which leads to the death of some of its more recent parts, particularly the uppermost branches; whence its withered top sometimes assumes the appearance of a stag's head of horns, which, from the indestructibility of these dead branches, it retains for many years; new branches springing out from the sides, of much luxuriance. This disease, similar to canker in the genus Pyrus, is generally concentrated to certain places of the bark and alburnum, the portion of branch above these places thence withering, the connection with the root being cut off; though sometimes the points of the twigs appear to be nipped, without any previous disease. From these affections, and also on account of the branches and stem being often rifted by the winds, the tree is frequently found with rot in the stem, when it has stood long. It agrees in this with the larch, that, though its timber, when cut down, or withered and dried, as on the top of the tree, is little liable to corruption, yet it is very subject to it, as part of the stem of the living tree, perhaps under certain circumstances of semi-vitality. To determine whether this tree, raised from seed, would be liable to these disorders, the same as when continued by slips, would be an interesting, though tedious, experiment. We never have seen any young seed-plants rise around old trees.

The use of the red wood willow, as timbers of vessels, has been of long standing in this part of Scotland, and has proved its long endurance, and excellent adaptation. By reason of its lightness, pliancy, elasticity, and toughness, it is, we think, the best, without exception, for the formation of small fast-sailing war-vessels. We are pretty certain that our Navy Board would not have cause to regret trial of it in a long, low, sharp schooner, of sufficient breadth to stand up under great press of sail, moulded as much as possible to combine great stability with small resistance from the water, and when in quick motion to be buoyant—especially not to dip forward,—provided it could be procured not too old, and free from rot, large knots, and cross-grain; a very little attention in the cultivation would afford it of the finest bends, and clean and fresh. Our Navy Board have received some slight teaching from our transatlantic brethren, of the superior sailing of fir-constructed vessels, to those of oak, the result of their superior lightness, pliancy, and elasticity.

The writer of this has also had experience of two vessels, one of oak, and the other of larch, on the same voyages, at the same time, and has found the latter superior in sailing to the former, in a degree greater than the difference of build could account for. From the superior elasticity and lightness of the willow, even to larch, the lightest and most elastic of the fir-tribe, we should expect that vessels of it would outstrip those of fir, at least of Scots or red pine, as much as the latter do those of oak; and that, from this greater elasticity and lightness, they would move through the water, yielding to the resistance and percussions of the waves, compared to those of oak, as a thing of life to a dead block. For vessel-timbers, this wood requires to be used alone; as, when mixed with other kinds less pliant or elastic, the latter have to withstand nearly all the impetus or strain, and are thence liable to be broken, or from the vessel yielding more at one place than another, she is apt to strain and become leaky.

Some years ago, when demolishing an old building which had stood fully a century, the writer found the large frames of the building, or ground *couples*, which, from their situation, could not have been renewed, to consist of this timber; and, with the exception of the outside, which was so much decayed, for about half an inch in depth, as the finger could pick it away, the body of the wood was as fresh as at first, still fit for any purpose, and of a beautiful pink or salmon colour. When we observed the mouldering exterior of these pieces, we laid one of the smallest hollow over a log, and struck it with a large wooden mallet, not doubting that it would go to fragments; such, however, was the *resilience*, that the mallet rebounded so greatly as almost to leap from our hands.

For country purposes, red-wood willow is employed in the construction of mill water-wheels, of the body or boarding of carts, especially of lining of carts employed in the carriage of stones, or of any utensil requiring strong, tough, light, durable boarding. Formerly, before the introduction of iron-hoops for cart-wheels, the external rim or felloe was made of willow; when new, the cart or wain was driven along a road covered with hard small gravel (in preference, gravel somewhat angular), by which means the felloe shod itself with stone, and thus became capable of enduring the friction of the road for a long time, the toughness and elasticity of the willow retaining the gravel till the stone was worn away. Under much exposure to blows and friction, this willow outlasts every other home timber. When recently cut, the matured wood is slightly reddish, and the sap-wood white. When exposed to the air and gradually dried, both are of salmon colour, and scarcely distinguishable from each other. Willow-bark is used in tanning; it also contains a bitter, said to be febrifuge.

RED-WOOD PINE—*Pinus.*

THIS tribe of the order Coniferæ, at once the most useful, and the most plentifully and widely extended over the North temperate zone—that portion of the earth more congenial to man, and which contains about four-fifths of his numbers, has a similitude of character and qualities more distinguishable by one glance of the eye than by laboured description. It consists of a number of kinds, which again divide into families and individuals perceptibly different from each other. The following are those whose timber is best known to us:

Scots fir, or Norway pine,	*Pinus sylvestris.*
Pinaster,	*Pinus Pinaster.*
Canadian red Pine[*] (foreign),	* * * *
Pitch pine (foreign),	* * * *

And, though a little more distinct,

Yellow American, or Weymouth Pine, *Pinus Strobus.*

Very little observation will distinguish these from the next useful great tribe of the Coniferæ with white wood, the Spruces and Silver Firs—Abies.

There are a number of foreign kinds of pine, some of great promise, recently introduced into Britain; but of whose adaptation for ship-building we cannot speak. Samples of the timber of *P. laricio*, *P. tæda*, *P. cembra*, *P. maritima*, *P. rigida*, &c. of British growth, may, however, soon be had of sufficient size for experiment. The common Scots fir is the only pine of British growth which has been employed as a naval timber; for which purpose, however, since the last peace, and the introduction of our larch, it is in very little demand.

An acute botanist, Mr G. Don of Forfar, a number of years ago, gave a description of the varieties of cultivated Scots fir which had come under his notice. The following is an abstract of his observations:

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[*] Red Canadian pine is generally termed *Pinus resinosa*; but as it is not so resinous as several other kinds, we consider *Pinus rubra* (*rubra* from the colour of stem and also of timber), which is sometimes used, more suitable. The pitch pine of the American United States should be *Pinus resinosa*.

"*Varieties of Pinus sylvestris.*

"Var. 1st. The common variety, well known by its branches forming a pyramidal head, the leaves marginated, of dark-green colour, but little glaucous underneath, the cones being considerably elongated and tapering to the point, and the bark of the trunk very rugged. This variety seems short-lived, becomming soon stunted in appearance.

"Var. 2d, Distinguishable from the former by disposition of branches, which are remarkable for horizontal disposition and tendency to bend downwards close to the trunk. The leaves are broader than var. 1st, and serrulated, not marginated; leaves are distinguishable at a distance by their much lighter and beautiful glaucous colour, the bark not so rugged as var. 1st, and the cones thicker and not so much pointed, and also smoother. This tree seems a hardy plant, growing freely in many soils: this variety may be named Pinus horizontalis. Var. 1st. much more general than var. 2d, and also sooner comes to seed, which is also easier gathered from the position of the branches.

"Var. 3d, Is of a still lighter colour than var. 2d, being of a light glaucous hue, approaching to a silvery tint; its branches form, like var. 1st, a pyramidal head, but it differs remarkably in its cones from both the former varieties; the cones of this seem beset with blunt prickles bent backwards, the leaves serrulated. This variety is rather more common than var. 2d; like it, it is a good tree.

"Var. 4th. The leaves somewhat curled or rather twisted, and much shorter than the others: this variety is very rare."

Our observation does not go to confirm these subdivisions. We think they are little more distinct than the fair, the red *, the black haired, the fair, the sallow, the brown complexioned, the tall, the short, of the same community or even family of men. There is variation and individuality more or less strongly marked in all kinds of organized beings: at least those vegetables which have exposed fructification possess it; many whose fructification is secluded also possess it; and the others of more constant character, such as some of the Gramineæ, with a little art (removing their anthers before the pollen bursts forth, and applying the pollen of others as near to them in the chain of life as can be found to be different, or changing the circumstances by culture), can also be rendered equally varia-

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* We think that in mankind the variations of the children of the same parents do not soften entirely—there would seem to be certain types or nuclei both of appearance and temperament around which external and internal character vibrates.

ble. These minor distinctions or individualities of vegetables become more perceptible as our observation closes in upon the object. We have never yet found one individual apple plant, raised from seed, to be the counterpart of another; but differing even in every part and habit, in bud, leaf, flower, fruit, seed, bark, wood, root; in luxuriance of growth; in hardihood; in being suited for different soils and climates, some thriving in the very moist, others only in the dry; in the disposition of the branches, erect, pendulous, horizontal; in earliness and comparative earliness of leaf, of flower, of fruit.

We hope the above remarks will not be lost on those who have the management of the sowing, planting, and thinning of woods, and that they will always have selection in view. Although numerous varieties are derived from the seed of one tree, yet if that tree be of a good *breed*, the chances are greatly in favour of this progeny being also good. Scots fir of good variety will thrive and reach considerable size and age, in almost any soil which is not very moist, or very arid and barren (such as our sand and gravel flats much impregnated with iron or other deleterious mineral), provided the plants from their earliest years have room to throw out and retain a sufficiency of side branches. This is especially necessary to their health where the soil is ungewind, the resulting vigour often overcoming the disadvantages. From the pine being found chiefly in the light sandy districts on the continent of Europe, and in the sandy pine barrens of America, an idea has gone abroad that these barren districts are more congenial to it than the more clayey, the more rocky, or the richer vegetable mould; but its natural location in the barren sandy districts results from its being more powerful in this soil than any other plant of the country, not from preference of this soil. Should any one doubt of this, let him take a summer excursion to Mar Forest, where no other tree having been in competition with Pinus sylvestris, and where it is spread over the hill and the dale, he will observe that it prospers best in good timber soil, and though comparatively preferring an easy soil, and having superior adaptation to thin or rocky ground, that its taste does not differ very materially from that of the plane or the elm, the oak or the ash.

In Mar Forest he will also observe (if they be not now all cut down) several well marked individuals of the *splatch* pine, esteemed a very valuable and hardy kind; and with the right which a botanist has in a plant sown by nature, he may bear off some of the seeds, and endeavour to spread this rare indigenous kind throughout the island. Should he be unsuccessful in finding these at Mar, he may return by Kenmore, where, on the side of the hill on the right bank of the Tay, near the confluence of the Lyon, he will find several trees, we think five, of this kind of pine, of considerable size, growing at one place, apparently planted: we were told the plants had been brought down from the natural forest farther up on the mountains. These are sufficiently distinct in character from the common Scots fir growing around, having a horizontal, straggling disposition of branches, the leaves being of a much lighter, different shade of green, and more tufted, and the bark of a yellower red, so as to merit a distinct name; and we should consider Pinus horizontalis as descriptive as any other, if it shall not appear to be only a sub-species of P. sylvestris. The descriptive name *splatch* fir, is from the prominences of the rugged bark not being in longitudinal ridges or flutes, but in detached flat oblong lumps, such as soft clay or mud takes when cast with force upon a wall. We, however, do not think this the same as Mr Don's var. 2d, at least we have noticed in our lowland woods raised by planting, such as Mr Don examined, individuals here and there having less or more resemblance to his described varieties, but none of them approaching the distinctness of this alpine Scots fir. The proprietors of this kind of pine will confer a benefit on the public by causing the timber be examined and compared with that of trees of equal size of the common Scots fir growing near, and making a public report of the number and size of annual growths, the number of these of matured and of sap wood, the comparative strength, density, quantity of resinous deposit, hardness, &c.

The Pinaster is a valuable kind of red-wood pine, with strong resinous timber, and from not having one-half the number of sap-wood layers of the common Scots fir, we should consider it deserving attention as a naval timber; but perhaps the small number of sap-layers is from want of climate: owing to the branches being larger, and, in proportion to their size, being joined to the stem with a larger swell than those of P. sylvestris, the timber is rougher with larger knots. In the very barren sand and gravel district near Christchurch, scarcely affording sustenance to lichens, and where even heaths will not grow, we have observed this tree make considerable progress, and outstrip the Scots fir in growth.

The Canadian Red Pine has been employed to a considerable extent in this country, both as planking and spars. It is inferior in strength and durability to the Baltic red pine, and would seldom make its appearance on this side the Atlantic while the Baltic was open to us, did not a very ill advised duty obstruct the supply of the better article. This timber is sometimes supplied with a good character by the shipwright, as it is soft, pliant, and easily worked. The Canadian red pine has a greater number of layers of sap-wood than any other red pine we are acquainted with; we have repeatedly counted 100 sap-wood layers. We have never seen this kind of pine growing in Britain.

The most common American pine, with yellow timber, Pinus strobus, has been introduced for a long time back into Britain, it is said first by the Earl of Weymouth, thence sometimes named Weymouth Pine. This rather elegant tree requires a warm sheltered situation, as it is easily torn down by wind, from the weakness of the timber, which is inferior in hardness and strength to any other pine we are acquainted with; and from its slender needle leaf not having substance to withstand the evaporation of much exposure. Altogether, the kind appears rather out of climate in Britain, and, though the monarch of the pines in Canada, holds here but a very subordinate place. Although extremely tender and light, the matured timber does not soon decay when cut out thin and exposed to wind and weather, nor worm when kept dry in houses; but when employed in shipbuilding,—remaining always between the moist and dry, the condition most favourable to putrefaction, and surrounded by a close, warm, putrid atmosphere,—it very soon, especially in masses, becomes corrupted. It requires more time to season or dry in the deal than any other wood, owing to the fineness of fibre, smallness of pores, and want of density. From this quality of parting with its moisture with extreme slowness, it forms convenient deck-planking for vessels on tropical stations, or when employed in carriage of unslacked lime, as the plank does not readily shrink and become leaky under the great evaporation occasioned by the heat and arid air. Yellow pine has generally about 40 growths of sap-wood.

We have had no acquaintance with American pitch pine as a growing tree. As a timber, it is superior in several respects to all the others, having a great deal more resinous matter, so much, as often to render it semitranslucent. It is strong and weighty, and is used as a naval timber for most of the purposes to which other pine timber is applied. It forms the very best bottom planking. The shipwrights of the docks at Devonport will attest its quality, as the bottom planking of the Gibraltar of 80 guns: this vessel carried home to England from the Mediterranean, a piece of coral rock of about ten tons weight sticking in her bottom, her preservation in all probability resulting from the adhesive quality of this timber. Its great weight is, however, a considerable inconveniency attending its use as spars, and the abundance of resin, we should think, would unfit it for tree-nails; resinous tree-nails,—probably from some derangement of the structure or disposition to chemical change produced in the resin by the very great pressure of the hard driving,—soon corrupting and infecting the adjacent wood. In some cases we have also known very resinous Baltic plank decay soon in vessels. The pitch pine, from the quantity of resin, contracts little in drying, at least for a long time, till the resin itself begins to dry up. It forms the best house-floors we have seen, being strong and durable, continuing close at joinings, and the fibre not readily taking in moisture when washed.

Our red-wood pine, when come to some age, is in wet ground attacked by rot, which commences in the bulb and adjacent roots and stem, in a manner very similar to the rot in larch. The red-wood also approaches nearer to the outside where this rot exists, and on the side of the tree where the rot is greatest. Most of our planted red pine forest, especially in poor wet tills, and in all flat sandy moorish ground of close subsoil, fall by decay at from 30 to 60 years old. This decay is gradual, owing to the difference in strength of constitution of the individuals. Closeness of rearing and consequent tall nakedness of stem, and disproportion of leaves to stem, would alone induce this in a few years longer even in good soil, excepting perhaps in protected narrow dells; but the decay commences much sooner when the soil is unfavourable, and is no doubt accelerated by the mode of extracting the seeds by kiln-drying the cones, and by using a weak variety of the plant. The approach of this decay may often be noticed, several years previous, in the saw-cross section of the stem mid-way up the tree—an irregular portion of the section appearing of a different shade, from breaking off free and irregular before the teeth of the saw, and not having so much fibrous cover as the healthy part. When Scots fir rises naturally, it is not nearly so subject to this decay even in very inferior soils: the plants having generally much more room from the first, do not rise so tall, have more branch in proportion to stem, thence are more vigorous. The cones not being injured by kiln-drying, may also account for this.

The fact that the red pine in Scotland has fewer sap-wood layers than the red pine of Memel or of North America, and also the fact that, in most situations in Scotland, the red pine soon decays—soon-est in the places where the trees have fewest sap-wood layers, and where the timber has been planted, that is, where the cones have been kiln-dried—is worthy of notice. Scots red pine has generally from 15 to 40 layers, Memel from 40 to 50, Canadian often 100. We consider the long moist open winter and cold ungenial spring in Scotland, and the till bottoms soaking with water, perhaps aided by the transplanting, and the kiln-drying of the cones, to be the cause of this early loss of vitality or change of sap-wood into matured. In Poland and Prussia, the earth does not remain so long cold and moist as in Scotland, but is either frozen or sufficiently warm and dry;—this occurs even to a greater degree in Canada*, and neither the Memel nor Canadian have any chance of being planted or kiln-dried.

White Larch—*Larix communis*, (*L. pyramidalis*).

White Larch is a timber tree combining so many advantages, its properties so imperfectly known, of so recent introduction, and of such general culture, (about 10,000,000 plants being sold annually from the nurseries of the valley of the Tay alone), that any accurate notice of its history, its habitudes, and uses, must possess an interest sufficient to arrest the attention of every one, from the statesman and economist down to the mere lord and the squire. We shall therefore devote to it a little more of our attention than we have bestowed on those already treated of.

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* The Canadian red pine resembles P. sylvestris or Norway pine so much, that it is usually styled Norway pine by the settlers: Though different, it is so nearly allied to P. sylvestris, that we consider the number of sap-growths may be referred to the climate and soil, and not to the kind,—that is, that, were it grown in Britain, if it did not at first, it would in the course of time come to have fewer sap-growths.

Larch is scattered over a considerable part of the northern hemisphere, inhabiting nearly the same regions with the other Coniferæ. White larch, the kind* common in Britain, is found growing extensively on the alpine districts of the south of Europe, in Italy, Switzerland, Sardinia; this may be termed the European temperate species. Another, native to the country around Archangel, and extending from

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* Our common larch, like almost every other kind of tree, consists of numberless varieties, which differ considerably in quickness of growth, ultimate size, and value of timber. This subject has been much neglected. We are, however, on the eve of great improvements in arboriculture; the qualities and habits of varieties are just beginning to be studied. It is also found that the uniformity in each kind of wild growing plants called *species*, may be broken down by art or culture, and that when once a breach is made, there is almost no limit to disorder; the *mele* that ensues being nearly incapable of reduction.

Norway eastward through Russia and Siberia, of inferior size, may be styled the European Hyperborean. North America, like the old world, is said to possess a temperate and hyperborean species. The first, Black Larch (L. pendula), more generally extending along the longitudinal parallel of the United States; the other, Red Larch (L. microcarpa), along that of Lower Canada and Labrador. We have seen the American temperate attain 18 inches in diameter in Scotland, but it is much inferior in figure and growth, and also cleanness of timber, to the Appenine or European temperate, being covered with knots and protuberances. Though rough, the timber is said to be of excellent quality.

It is now upwards of 80 years since the larch, so common in Britain, was brought from the Appenines to Strath-Tay. The rapidity of its growth and striking novelty of appearance, assisted by the influence of the family of Athole (to a female of which some say we owe its first introduction), soon attracted general attention: it quickly spread over the neighbouring country, and was planted in every variety of soil and situation, from the unfitness of which, in most places of the low country, it is already fast decaying. About 40 years ago it began to be planted in many parts of Britain. It is now introduced into almost every new plantation in the two islands, and the space of country covered by its shade is extending with a rapidity unparalleled in the history of any other ligneous plant.

Larch is generally conceived to be an alpine * plant, and its decay in the low country attributed to situation or climate. This idea seems to have arisen from its locality in Italy, and from observing it succeed so well in our alpine districts, not taking into account that the soil is different,—that it may be the soil of these districts which conduces to the prosperity of the larch, and not the latitude. Throughout Scotland, wherever we have observed the decay, it appeared to have resulted almost solely from unsuitableness of soil. We have witnessed it as much diseased on our highest trap hills, 1000 feet in altitude, as on a similar soil at the base. Yet the freeness from putrescency or miasma of the pure air of the mountain,

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* There is yet no sufficient data for the term alpine plant, but with reference to latitude. The influence on vegetables, arising from rarefaction and diminution of pressure of atmosphere, from difference of stimulus of solar ray—when the entire ray of light, heat, and chemical power, though less intense, is radiated fresh, and not much broken or modified by refraction and reflection, and heat communicated more in proportion by radiation than by contact of heated air; or from difference of electric or galvanic or other meteoric impression connected with altitude or ranges of mountains, or with primary rocks or more upright strata, has not been made the subject of research, at least has not been sufficiently investigated by any naturalist.

and deficiency of putrescent matter in the ground, or other more obscure agencies connected with primitive ranges, may have some influence to counterbalance unsuitableness of soil. It is not probable that the coolness and moisture of altitude would be necessary in Scotland to the healthy growth of a vegetable which flourishes under Italian suns, on the general level of the Appenine and on the Sardinian hills.

The rot, so general in growing larch, though sometimes originating in the bulb or lower part of the stem, seems to have its commencement most frequently in the roots. Thence the corruption proceeds upwards along the connecting tubes or fibres into the bulb, and gradually mounts the stem, which, when much diseased, swells considerably for a few feet above the ground, evidently from the new layers of sap-wood forming thicker to afford necessary space for the fluids to pass upward and downward—the matured wood through which there is no circulation approaching at this place within one or two annual layers of the outside. In a majority of cases, the rot commences in the roots which have struck down deepest into the earth, especially those under the stool; these having been thrown to a considerable depth by the young plant, as the tree enlarges, are shut out from aëration, &c. by the superior increasing stool and hard-pressed earth underneath it; this earth at the same time becoming exhausted of the particular pabulum of the plant. It is, therefore, quite probable, from these parts of the roots being the weakest, that they will be most susceptible of injury from being soaked in stagnant water in the flat tills *, starved during droughts in light sand, tainted by the putrid vapours of rich vegetable mould, or poisoned by the corrosive action of pernicious minerals. It may also be supposed that these smothered sickly roots, not possessing sufficient power or means of suction (endosmose), will be left out in the general economy of vegetation of the plant, thence lose vitality, and become corrupt. But this affords no explanation why the larch roots, under these circumstances, are more liable to corruption than those of other trees, or how the bulb itself should become contaminated.

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* When water is stationary, either in the pores of the soil or by itself, if the temperature be not very low, a slight putrefaction generally commences, aided by the dead vegetable or animal matter contained in the soil or the water; and it is only the more robust aquatic vegetables whose juices are not corrupted, from their roots being soaked in this tainted fluid. It would appear, too, that the aqueous part of the atmosphere is also susceptible of the same putrid changes, although in general the putrescency may have commenced before the evaporation. This condition of the aqueous part of the atmosphere is a disposing cause to blight or mildew in vegetables, and remittent, intermittent, and putrid fevers in man. Mill-ponds are notorious both for mildew and agues.

We have cut off the top, where the diameter of the section was about three inches, from sound young larch trees, and found a similar rot proceed downwards in a few months from the section, as rises from the diseased roots in improper soil. There is something favourable to the quick progress of this rot in the motion of the sap, or vitality of the tree; as, under no common circumstances, would the wood of a cut larch tree become tainted in so short a time.

The rot, though most general in trees which are chilled in wet cold tills, or starved in dry sand, or sickly from any other cause, is also often found to take place in the most luxuriant growing plants in open situations, branched to the ground, and growing in deep soil free from stagnating water. There must, therefore, be some constitutional tendency to corruption in the larch, which is excited by a combination of circumstances; and we must limit our knowledge for the present to the fact, that certain soils, perhaps slightly modified by other circumstances, produce sound, and others unsound larch, without admitting any general influence from altitude, excepting in so far as its antiseptic influence may go.

The fitness of soil for larch seems to depend more especially upon the ability the soil possesses of affording an equable supply of moisture; that is, upon its mechanical division, or its powers of absorption or retention of moisture; and its chemical composition would seem only efficacious as conducive to this.

Soils and subsoils* may be divided into two classes. The first, where larch will acquire a size of from 30 to 300 solid feet, and is generally free of rot; the second, where it reaches only from 6 to 20 feet solid, and in most cases becomes tainted with rot before 30 years of age.

CLASS I. SOILS AND SUBSOILS PROPER FOR LARCH.

Sound rock, with a covering of firm loam, particularly when the rock is jagged or cloven, or much dirupted and mixed with the earth.—In such cases, a very slight covering or admixture of earth will suffice. We would give the preference to primitive rock, especially micaceous schist and mountain limestone. Larch seldom succeeds well on sandstone or on trap, except on steep slopes, where the rock is quite sound and the soil firm.

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* We have had no experience of larch, excepting very young, growing on chalk and its affinities. We are told there are a few instances where larch has reached 50 years in these calcareous soils, some distance south of London. This merits attention.

Fully the one half of Scotland, comprehending nearly all the alpine part, consists of primary rock, chiefly micaceous schist and gneiss. These rocks are generally less decayed at the surface, better drained, and fuller of clefts and fissures containing excellent earth (especially on slopes), into which the roots of trees penetrate and receive healthy nourishment, than the other primitive and transition rocks, granite, porphyry, trap, or the secondary and tertiary formations of nearly horizontal strata, red and white sandstone, &c. Primary strata are generally well adapted for larch, except where the surface has acquired a covering of peat-moss, or received a flat diluvial bed of close wet till or soft moorish sand, or occupies a too elevated or exposed situation—the two latter exceptions only preventing the growth, not inducing rot.

Gravel, not too ferruginous, and in which water does not stagnate in winter, even though nearly bare of vegetable mould, especially on steep slopes, and where the air is not too arid, is favourable to the growth of larch. It seems to prefer the coarser gravel, though many of the stones exceed a yard solid.

The straths or valleys of our larger rivers, in their passage through the alpine country, are generally occupied, for several hundred feet of perpendicular altitude up the slope, by gravel, which covers the primitive strata to considerable depth, especially in the eddies of the salient angles of the hill. Every description of tree grows more luxuriantly here than in any other situation of the country; the causes of this are, 1*st*, The open bottom allowing the roots to penetrate deep, without being injured by stagnant moisture; 2*d*, The percolation of water down through the gravel from the superior hill; 3*d*, The dryness of the surface not producing cold by evaporation, thence the ground soon heating in the spring; 4*th*, The moist air of the hill refreshing and nourishing the plant during the summer heats, and compensating for the dryness of the soil; 5*th*, The reverberating of the sun's rays, between the sides of the narrow valley, thus rendering the soil comparatively warmer than the incumbent air, which is cooled by the oblique currents of the higher strata of air, occasioned by the unequal surface of the ground. This comparatively greater warmth of the ground, when aided by moisture, either in the soil or atmosphere, is greatly conducive to the luxuriancy of vegetation.

Firm dry clays and sound brown loam.—Soils well adapted for wheat and red clover, not too rich, and which will bear cattle in winter, are generally congenial to the larch.

All very rough ground, particularly ravines, where the soil is neither soft sand nor too wet; also the sides of the channels of rapid rivulets.—The roots of most trees luxuriate in living or flowing water; and, where it is of salubrious quality, especially when containing a slight solution of lime, will throw themselves out a considerable distance under the stream. The reason why steep slopes, and hills whose strata are nearly perpendicular to the horizon, are so much affected by larch and other trees, is, because the moisture in such situations is in motion, and often continues dripping through the fissures throughout the whole summer. The desideratum of situation for larch, is where the roots will neither be drowned in stagnant water in winter, nor parched by drought in summer, and where the soil is free from any corrosive mineral or corrupting mouldiness.

Larch, in suitable soil, sixty years planted, and seasonably thinned, will have produced double the value of what almost any other timber would have done; and from its general adaptation both for sea and land purposes, it will always command a ready sale.

CLASS II. SOILS AND SUBSOILS WHERE LARCH TAKES DRY ROT.

Situations (steep slopes excepted) with cold till subsoil, nearly impervious to water.—The larch succeeds worst when moorish dead sand alone, or with admixture of peat, occupies the surface of these retentive bottoms. Where the whole soil and subsoil is one uniform, retentive, firm till, it will often reach considerable size before being attacked by the rot. When this heavy till occupies a steep slope, the larch will sometimes succeed well, owing to the more equable supply of moisture, and the water in the soil not stagnating, but gliding down the declivity.

In general, soils whose surface assumes the appearance of honeycomb in time of frost, owing to the great quantity of water imbibed by the soil, will not produce large sound larch. More than half the low country of Scotland is soil of this description.

Soft sand soil and subsoil.—Sand is still less adapted for growing larch than the tills, the plants being often destroyed by the summer's drought before they attain size for any useful purpose: the rot also attacks earlier here than in the tills. It appears that light sand, sloping considerably on moist back-lying alpine situations, covered towards the south by steep hill, will sometimes produce sound larch; whereas did the same sand occupy a dry front or lowland situation, the larch would not succeed in it. The same moist back situation that conduces to produce sound larch in light dry soils, may probably tend to promote rot in the wet. The moisture and the less evaporation of altitude may also, in some degree, diminish the tendency to rot in dry light sand, and increase it in wet till. Larch will sometimes succeed well in sharp dry alluvial sand left by rivulets.

Soils incumbent on brittle dry trap, or broken slaty sandstone.—Although soil, the debris of trap, be generally much better adapted for the production of herbaceous vegetables than that of sandstone or freestone, yet larch does not seem to succeed much better on the former than the latter. The deeper superior soils, generally incumbent on the recent dark red sandstone, are better suited for larch than the shallow inferior soils incumbent on the old grey and red sandstone.

Ground having a subsoil of dry rotten rock, and which sounds hollow to the foot in time of drought.

Rich deaf earth, or vegetable mould.—Independently of receiving ultimate contamination from the putrid juices or exhalations of this soil, the larch does not seem, even while remaining sound, to make so much comparative progress of growth, as some of the hard wood trees, as elm, ash, plane.

Black or grey moorish soils, with admixture of peat-moss.

Although the soils specified in this class will not afford fine large larch for naval use, yet they may be very profitably employed in growing larch for farming purposes, or for coal-mines, where a slight taint of rot is of minor importance. The lightness of larch, especially when new cut (about one-third less weight than the evergreen coniferæ), gives a facility to the loading and carriage, which enhances its value, independent of its greater strength and durability. Those larches in which rot has commenced, are fully as suitable for paling as the sound: they have fewer circles of sap-wood, and more of red or matured. When the rot has commenced, the maturing or reddening of the circles does not proceed regularly, reaching nearest the bark on the side where the rot has advanced farthest.

A great amelioration of our climate and of our soil, and considerable addition to the beauty and salubrity of the country, might be attained by landholders of skill and spirit, did they carry off the noxious moisture, by sufficient use of open drainage, from their extensive wastes of mossy moors and wet tills, which are only productive of the black heath, the most dismal robe * of the earth, or rather the funeral pall with which Nature has shrouded her undecayed remains. This miserable portion of our country, so dreary when spread out in wide continuous flats, and so offensive to the eye of the traveller, unless his mind is attuned to gloom and desolation, lies a disgrace to the possessor. Were a proper system of superficial draining executed on these districts, and kept in repair, most of our coniferæ, particularly spruce and Scots fir, with oak, beech, birch, alder, and, in the sounder situations, larch, would thrive and come to maturity, ultimately enhancing the value of the district an hundred fold. This could be done by fluting the ground, opening large ditches every 30, 50, or 100 yards, according to the wetness or closeness of the subsoil—the deeper, the more serviceable both in efficacy and distance of drainage. These flutes should stretch across the slope with just sufficient declivity to allow the wa-

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* "Oh! the bonny blooming heather."—"Man has spoken evil things of the sun, of love, and of life."

ter to flow off easily. The excavated matter should be thrown to the lower side; and when the whole, or any part, of the excavation consists of earth or gravel, it ought to be spread over the whole mossy surface, whether the field be morass or drier hill-peat: this would be useful in consolidating it, and in preventing too great exhaustion of moisture in severe droughts, from which vegetation in moss-soil suffers so much. Even though planting were not intended, this fluting and top-dressing would facilitate the raising of the gramineæ. These ditches, when the ground is not too stoney, or too moist, or containing roots, might be scooped out, excepting a little help at the bottom, by means of a scoop-sledge, or levelling box, worked by a man and two horses, the surface being always loosened by the common plough: one of these will remove earth as fast as twenty men with wheelbarrows.

ON BENDING AND KNEEING LARCH.

We cannot too forcibly inculcate the urgent necessity of attending to the bending of the larch: for our country's interest, we almost regret we cannot compel it. In all larch plantations, in proper soil, not too far advanced, and in all that may hereafter be planted, a proportion of those intended to remain as standards should be bended. The most proper time for this would perhaps be May or June, before the top-growth commences, or has advanced far; the best size is from three feet high and upwards. The plants should be bent the first season to an angle of from 40° to 60° with the horizon, and the next brought down to from 10° to 60°, according to the size of the plant, or the curve required,—the smallest plants to the lowest angle.

From experience we find that the roots of larch form the best of all knees; they, however, might be much improved by culture *, although it does not

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* As we held this plan of forming larch knees, and of bending larch, of considerable importance, we some time ago presented it in manuscript, along with some other matter, to the Highland Society of Scotland. Tiring, however, of the delay of examination, perhaps unavoidable in their official departments, and from some improvements occurring to us during the delay, we requested it back. We now present it under this more convenient form to the Society, and hope they will find the examination or perusal of it printed, not quite so impracticable as when in manuscript. It will afford us pleasure to know that this useful Society approves, and that the members who have opportunity are setting about following our directions. We especially recommend to them to probe the roots of their growing larch, and to lay bare those fitted for knees.

seem as yet to have been attempted or thought of. To form the roots properly into knees, should the plants be pretty large, the planter ought to select those plants which have four main roots springing out nearly at right angles, the regularity of which he may improve a little by pruning, and plant them out as standards in the thinnest dryest soil suited for larch, carefully spreading the roots to equal distances and in a horizontal position. To promote the regular square diverging of these four roots, he should dig narrow ruts about a foot deep and three feet long out from the point of each root, and fill them in with the richest of the neighbouring turf along with a little manure. When the plants are small, and the roots only a tuft of fibres, he should dig two narrow ruts about eight feet long crossing each other at the middle at right angles, fill these as above, and put in the plant at the crossing: the rich mould of the rotted turf and its softness from being dug, will cause the plant to throw out its roots in the form of a cross along the trenches. When the plants have reached five or six feet in height, the earth may be removed a little from the root, and, if more than one stout root leader have run out into any of the four trenches, or if any have entered the unstirred earth, they ought all to be cut excepting one, the stoutest and most regular in each trench. In a few years afterwards, when the plants have acquired some strength, the earth should be removed gradually, baring the roots to from two to five feet distance from the stool, or as far as the main spurs have kept straight, cutting off any side-shoots within this distance, should it be found that such late root-pruning does not induce rot. This process of baring the roots will scarcely injure the growth of the trees, as the roots draw the necessary pabulum from a considerable distance, nor, if done carefully, will it endanger their upsetting; and the roots, from exposure to the air, will swell to extraordinary size *, so as to render them, ere long, the firmest rooted trees in the wood. The labour of this not amounting to the value of sixpence each, will be counterbalanced thrice

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* The landlord agriculturist is sufficiently aware of the influence of the baring the upper part of the root of turnip, while the plant is young, in extending the future growth of the bulb, and that a dry situation gives most root in proportion to stem. These are general laws in vegetation. There are few observers who have not remarked the very large size which roots have attained when the trees have originally been planted on dikes, and the dike earth removed, leaving the roots bare. Should any person examine the very great difference of thickness between the upper and lower part, from the heart of a root near the bulb, he will at once discover the influence of exposure to the air and freeness from pressure in promoting the swelling.

over by the ease of grubbing the roots for knees; and the whole brought to the shipwright will produce more than double the price that the straight tree alone would have done.

The forester should also examine and probe the roots of his growing larch, even those of considerable size, in sound ground; and when several strong horizontal spurs, not exceeding four, are discovered nearly straight, and from two to five feet long, he ought to bare these roots to that distance, that they may swell, carefully pruning away any small side-roots, and reserve these plants as valuable store, taking good heed that no cart-wheel in passing, or feet of large quadruped, wound the bared roots. In exposed situations the earth may be gradually removed from the roots.

The rot in larch taking place in the part appropriate to knees, the forester cannot be too wary in selecting the situations where there is no risk of its attack, for planting those destined for this purpose. It is also desirable, if possible, to have the knee timber in ground free of stones or gravel, as the grubbing in stoney ground is expensive, and the roots often embrace stones which, by the future swelling of the bulb, are completely imbedded and shut up in the wood, particularly in those places between the spurs where the saw section has to divide them for knees. Were the roots carefully bared at an early period, it would tend to prevent the gravel from becoming imbedded in the bulb. Nothing can be more annoying to the shipwright, when he has bestowed his money, ingenuity, and labour, upon an unwieldy root, and brought his knees into figure at the cost of the destruction of his tools by the enveloped gravel, to discover stains of incipient rot which renders it lumber.

This plan of baring the roots might be extended to oak trees for knees, baring and pruning about a foot out from the bulb annually. By exposure to the air, the timber of the root would mature and become red wood of sufficient durability. When covered with earth, the root of the oak remains white or sap wood, and soon decays after being dug up, the matured wood of the stem scarcely extending at all underneath the surface of the ground. The roots of the pine tribe are the reverse of this, at least the bulb and the spurs near it, are the best matured, reddest, toughest, most resinous, part of the tree. It is probably unnecessary to observe, that it would be folly to remove the earth from the bulb of trees in situations where water would stand for any length of time in the excavation.

Larch knees are possessed of such strength and durability, and are of such adaptation by their figure and toughness, that were a sufficient quantity in the market, and their qualities generally known, we believe that none else would be used for vessels of any description of timber—even for our war-navy of oak. In America, where it is difficult to procure good oak knees in their close forest, it is customary to use them of spruce roots even for their finest vessels. The knees of vessels have a number of strong bolts, generally of iron, passing through them to secure the beam-ends to the sides of the ship. Larch knees are the more suited for this, as they do not split in the driving of the bolts, and contain a resinous gum which prevents the oxidation of the iron.

As the larch, unlike the oak, affords few or no crooks naturally, excepting knees, the artificial formation of larch crooks is of the utmost consequence to the interest of the holders of larch plantations now growing. In order to obtain a good market for their straight timber, it is absolutely necessary to have a supply of crooks ready as soon as possible to work the straight up. This would increase the demand, and thence enhance the price of the straight more than any one not belonging to the craft could believe. In good soil many of the crooks would be of sufficient size in twenty years to begin the supply, if properly thinned out. In a forest of larch containing many thousand loads, and which had been untouched by any builder, we have seen the greatest difficulty in procuring crooks for one small brig. It is only on very steep ground, and where the tree has been a little upset after planting, that any good crooks are found. From the rather greater diameter required of larch timbers, and also from the nature of the fibre of the wood, we should suppose that steam bending of larch timbers would scarcely be followed, even as a *dernier ressort*.

Larch, from its great lateral toughness, particularly the root, and from its lightness, seems better adapted for the construction of shot-proof vessels than any other timber; and opposed *end-way* to shot in a layer, arch fashion, several feet deep around a vessel, would sustain more battering than any other subject we are acquainted with, metal excepted. Were the part above water of a strong steam-vessel, having the paddles under cover, a section of a spheroid or half-egg cut longitudinally, and covered all around with the root cuts of larch five or six feet deep with the hewn down bulb, external; well supported inside, having nothing exposed outside of this arch, and only a few small holes for ventilators and eyes; there is no shot in present naval use that would have much impression upon it. Had such a vessel a great impelling power, and a very strong iron cutwater, or short beak wedge-shaped (in manner of the old Grecian galleys), projecting before the vessel under water, well supported within by beams radiating back in all directions, she might be wrought to split and sink a fleet of men-of-war lying becalmed, in a few hours. This could be done by running successively against each, midships, and on percussion immediately backing the engine, at same time spouting forth missiles, hot water, or sulphuric acid from the bow to obstruct boarding; but even though the external arch were covered with assailants like a swarm of bees, they would be harmless, or could be easily displaced. To prevent combustion by red hot shot, the larch blocks, after drying, might have their pores filled by pressure with alkali. However, the employment of bomb-cannon about to be introduced in naval warfare, throwing explosive shot, regulated with just sufficient force to penetrate without passing through the side of the opposed vessel, will render any other than metallic defensive cover ineffectual; but this circumstance will, at the same time, completely revolutionize sea affairs, laying on the shelf our huge men-of-war, whose place will be occupied with numerous bomb-cannon boats, whose small size will render them difficult to be hit, and from which one single explosive shot taking effect low down in the large exposed side of a three decker will tear open a breach sufficient to sink her almost instantly. *For the construction of these boats, larch, especially were a proportion bent, would be extremely suitable, and thence larch will probably, ere long, become our naval stay.*

Larch has been used in the building-yards of the Tay for 20 years back; and there is now afloat several thousand tons of shipping constructed of it. The Athole Frigate built of it nearly 12 years ago, the Larch, a fine brig built by the Duke of Athole several years earlier, and many other vessels built more recently, prove that larch is as valuable for naval purposes as the most sanguine had anticipated. The first instance we have heard of British larch being used in this manner, was in a sloop repaired with it about 22 years back. The person to whom it had belonged, and who had sailed it himself, stated to us immediately after its loss, that this sloop had been built of oak about 36 years before; that at 18 years old her upper timbers were so much decayed as to require renewal, which was done with larch; that 18 years after this repair this sloop went to pieces on the remains of the pier of Methel, Fifeshire, and the top timbers and second foot-hooks of larch were washed ashore as tough and sound as when first put into the vessel, not one spot of decay appearing, they having assumed the blue dark colour which some timber acquires in moist situations, when it may be stiled *cured;* being either no longer liable to the putrid change constituting dry rot, or which forms timber into a proper soil for the growth of dry rot; or, from this blueness caused by the union of the tannin with iron acting as a poison on vegetation: this blueness, resulting from some alteration in the balance of affinities, occurs chiefly in timber containing much of the tannin principle, in which larch abounds. The owner of a larch brig who had employed her for several years on tropical voyages, also assures us that the timber will wear well in any climate, and that he would prefer larch to any other kind of wood, especially for small vessels; he also states that the deck of this brig, composed of larch plank, stood the tropical heat well, and that it did not warp or shrink as was apprehended.

From the softness of the fibre and want of density of the larch, we would not deem it suitable for planking vessels beyond the size of ordinary merchantmen, say 500 tons, as in the straining of very large vessels, when the greatest force comes upon the outward skin, the fabric of the wood might crush before it, along the edge of the plank, and throw (chew) the oakum. In ordinary sized vessels, however, larch plank retains the oakum better than oak, from greater lateral elasticity. For the purpose of timbers, if root-cuts *, and properly bent, we would think larch suitable to the largest class of vessels; as, though light, it is tough and quite free from knot, crack, or cross-grain, which is so common in oak, and which occasions dense old oak in large masses to give way at once, before a shock or strain, the hardness and unyielding nature of the fibre concentrating the whole dirupting impetus to one point. Larch may also be advantageously employed in the ceiling or inside skin of the part of war vessels above water: shot bores it, comparatively, like an auger,—thence the structure will endure longer under fire, and life be much economized.

In all places where larch has become known, it has completely superseded other timber for clinker-

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* As you ascend the tree the timber deteriorates greatly.

built boats, surpassing all others in strength, lightness, and durability. For this purpose, young trees of about 9 inches diameter, in root-cuts from 10 to 20 feet in length, with a gentle bend at one end, such as the larch often receives from the south-west wind, are the most suitable. The log should be kept in the bark till used, and in dry weather the boards put upon the boat's side within two or three days from being sawn out, as no timber we are acquainted with parts sooner with its moisture than larch; and the boards do not work or bend pleasantly when dry. When dried, the thin larch board is at once strong, tough, durable, and extremely light. The tough strength, almost equalling leather, is owing to the woven or netted structure of the fibre of the wood, entirely different from the pine, whose reedy structure runs parallel with very slight connecting or diverging fibres. It is very difficult to split larch even by wedges.

For rural purposes generally, larch is incomparably the best adapted timber, especially for rail or fence, or out-door fabric exposed to wind and weather. It is also getting into use for implements of husbandry, such as harrows, ploughs, and carts. We have seen a larch upright paling, the timber of which, with the exception of the large charred posts, had only been eight years in growing, standing a good fence, sixteen years old, decked out by moss and lichen in all the hoary garniture of time.

In the construction of buildings, larch is valuable only for the grosser parts, as beams, lintels, joists, couples. For the finer boarded part, it is so much disposed to warp, and so difficult to be worked, as generally to preclude use. It is, however, asserted that if larch be seasoned by standing two years with the bark stripped from the bole before being cut down, that the timber becomes manageable for finer house work.

Although larch timber be extremely durable in exposed situation, yet it yields to the depredations of insects fully as soon as any pine timber in close houses. We have proof of it in house-furniture about 50 years old, but it is considerably moth-eaten by apparently a smaller insect than common. Larch stools also disappear in forests sooner than the stools of Scots fir, being eaten by a species of beetle; and the sea-worm devours larch in preference to almost any other wood.

We have looked over some experiments conducted at Woolwich, in trial of the comparative strength of larch and other fir timber, where the larch is stated inferior to Riga and Dantzic fir, Pitch pine, and even Yellow pine. Larch, in the districts of Scotland where it is grown and much in use, is universally allowed to be considerably stronger than other fir; and the sawyers of it have one-fourth more pay per stated measure. We, ourselves, have had considerable experience of the strength of larch applied to many purposes, and have found it in general much superior in strength to other fir. We have known a crooked topmast of this timber, to which the sailors bore a grudge, defy their utmost ingenuity to get carried away. We once had four double horse-carts, made (excepting the wheels) of peeled young larch of rather slow growth, for the carriage of large stones; these, by mistake, were made very slight, so light, that, without the wheels, a man could have carried one of them away. When we saw the first loading of stones nearly a ton weight each, two in each cart, and the timber yielding and creaking like a willow-basket, we did not expect they would have supported the weight and jostlings of a rugged road many yards; yet they withstood this coarse employment for a long time. The timber of larch near the top of the tree is, however, very inferior and deficient in toughness; and it is not improbable that the experiments above alluded to at Woolwich had been made with larch timber deficient in strength from being a top. White larch has comparatively smaller and more numerous branches than any other of the Coniferæ; consequently the timber is freer of large knots, and has more equable strength, as well in small spars as when large and cut out into joists and beams, provided the timber be not too far up the tree. *Larch, however, compared with pines and firs, has the timber much stronger when young, and several inches or below a foot in diameter, than when old and large:* this may partly be owing to its deficiency in resinous deposit.

PART III.

MISCELLANEOUS MATTER CONNECTED WITH NAVAL TIMBER.

NURSERIES.

MUCH of the luxuriance and size of timber depending upon the particular variety of the species, upon the treatment of the seed before sowing, and upon the treatment of the young plant, and as this fundamental subject is neither much attended to nor generally understood, we shall take it up *ab initio.*

The consequences are now being developed of our deplorable ignorance of, or inattention to, one of the most evident traits of natural history, that vegetables as well as animals are generally liable to an almost unlimited diversification, regulated by climate, soil, nourishment, and new commixture of already formed varieties. In those with which man is most intimate, and where his agency in throwing them from their natural locality and dispositions has brought out this power of diversification in stronger shades, it has been forced upon his notice, as in man himself, in the dog, horse, cow, sheep, poultry,—in the apple, pear, plum, gooseberry, potato, pea, which sport in infinite varieties, differing considerably in size, colour, taste, firmness of texture, period of growth, almost in every recognisable quality. In all these kinds man is influencial in preventing deterioration, by careful selection of the largest or most valuable as breeders; but in timber trees the opposite course has been pursued. The large growing varieties being so long of coming to produce seed, that many plantations are cut down before they reach this maturity, the small growing and weakly varieties, known by early and extreme seeding, have been continually selected as reproductive stock, from the ease and conveniency with which their seed could be procured; and the husks of several kinds of these invariably kiln-dried *, in order that the seeds might be the more easily extracted! May we, then, wonder that our plantations are occupied by a sickly short-lived puny race, incapable of supporting existence in situations where their own kind had formerly flourished—particularly evinced in the genus Pi-

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* If the heat and evaporation of a gardener's pocket for several days be sufficient to render the seeds of melons and gourds productive of plants of earlier maturity, that is less disposed to extension and more to reproduction,—what may be expected from kiln-drying fir-cones?

nus, more particularly in the species Scots fir; so much inferior to those of Nature's own rearing, where only the stronger, more hardy, soil-suited varieties can struggle forward to maturity and reproduction?

We say that the rural economist should pay as much regard to the breed or particular variety of his forest trees, as he does to that of his live stock of horses, cows, and sheep. That nurserymen should attest the variety of their timber plants, sowing no seeds but those gathered from the largest, most healthy, and luxuriant growing trees, abstaining from the seed of the prematurely productive, and also from that of the very aged and over-mature; as they, from animal analogy, may be expected to give an infirm progeny, subject to premature decay.

As, from many facts, a considerable influence is known to result in several vegetables from drying severely the seeds from whence they had sprung *,—from exposure of these seeds to the sun and air,—from long keeping, or from injury by mould or im-

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* The full ripening of the seeds of some cultivated varieties of vegetables, and also the drying of the seeds severely without artificial heat, are found to have considerable influence upon the germination of the seeds, and even some impression upon the character of the resulting plant.

pure air, which all tend to shorten the life of the resulting individual, to accelerate the period of its seeding, and to increase its reproductiveness; the nurseryman should pay the utmost attention to the seeds he makes use of, procuring them as recent as possible, and preserving them in well-aired lofts, or under sheds, and also retaining them in the husks till the time of sowing: the superior germinating power of the seed thus treated will repay this attention.

From facts we are also assured, that, in some hard wood kinds, and also in the Coniferæ, the hanging of the growth of the young plant, the spindling up in the seed-bed, or injudicious deterring treatment afterwards, have a tendency to injure the constitution of the individual, inducing premature seeding, and diminutive old age; and also, that when plants, especially of some size, of these kinds of trees have their roots much broken, the secondary or new roots often partake something of the nature of the infirm runners, which, in most kinds of trees, are thrown out by layers,—the resulting tree, as in the case of those from layers in fruit trees being dwarfish, sooner exhausting itself by reproduction, and sooner decaying. For distinctness, we shall recapitulate:

That the seed be from the largest, hardiest variety of tree in luxuriant growth.

That the seed be recent, and carefully preserved in husk till sowing, and extracted from the husk or cone without artificial drying.

That the nursery be in an open, rather exposed situation,—most eligible without shelter either of tree, hedge or wall, of rather light dry soil of ordinary quality, of dry climate, and, in preference, soil naturally good to that made so by high manuring.

That the plants be not too close, nor remain too long in the seed-bed; that they be extricated without much fracture of root, and be replanted in wide rows, with good space between the plants in the row, keeping the roots as superficially extended as they will thrive, and without doubling the main root up to the surface of the ground.

That the plant receive no pruning, excepting in the case of more than one leader appearing, or feeder unproportionally extended; and no root-section, in order to retard its growth, or increase the number of root-fibres; and that its ultimate removal be accomplished without much fracture of root or branch.

By exposed situation of nursery, ordinary quality of soil, and much room in the seed-bed and rows, we shall have plants with firm fibre and hardy constitution, with thick juicy bark, thick stem at the surface of ground, and numerous feeders all the way down the stem. Roots are most easily extricated from light soil, and with least fracture. They are large in proportion to stem in dry soil and climate, and when they are situated near the surface of the ground.—A healthy growing plant, of firm fibre, large root, and sturdy short stem of one leader and numerous feeders, is the great desideratum: a large root is the more desirable, as a considerable part of it is generally broken off in transplanting, rendering it disproportioned to the top, which, in consequence, either languishes, or receives deterring cropping.

We consider, that a tree grows more luxuriantly, acquires larger size, and is much longer of reaching senility, when it is furnished with several large roots, say one or two to each of the cardinal points, extending horizontally out with bold leaders, than when numerous small rootlets diverge in all directions from the bulb, as is the case in some kinds when much fracture of root takes place from frequent removals, or, when the nursery is of moist or mossy soil, the plants being removed when of considerable size. We have cut down old stunted hard wood trees having extremely numerous crowded roots, all engrafted into a matted net throughout the soil near the bulb, and without any strong extended leaders. We attributed this crowded rooting to the plants having been of considerable size when put in, and losing their natural leaders; the situation, an avenue exposed to cattle, went to confirm the probability that the defect of the rooting had been owing to the largeness of the plants.

When a tree is supplied by numerous, consequently small and not wide-extending roots, as the tree acquires size, the wide spreading branches and leafy top shed off the rain and dews from the space occupied by these roots, very few of them extending beyond this shade; at the same time, this narrow space becomes soon exhausted of the more particular pabulum necessary to the kind of plant, the exhaustion being accelerated by the dryness. This dryness and exhaustion of the soil very soon show their effects aloft; the living bark of the tree becomes covered from its connexion with the air, and constricted by a thick hard dead crust, which, with the consequent very thin alburnum affording an inefficient communication between the supply and demand, react to impair the general vigour, and particularly to impede the descent of the proper sap necessary to the enlargement and further extension of the roots. The buds not receiving sufficient supply of root-moisture, instead of pressing on to new formation of wood, only find enough to burgeon out into flower-buds, which the following season drain the tree by reproduction; this fruit-bearing alternates with periods of exhaustion, when the buds have not even supply sufficient to swell into the embryo of flower and seed, but extend only into a few leaves; and sometimes, in the event of a benign season, the buds may throw out a small extension of new shoots. The tree progresses very slowly in thickness of bole all this time, and generally soon falls a prey to disease. On the other hand, when the tree has its naturally fine large roots preserved, and is situated in open forest, and mixed with other kinds, these large roots diverging widely from the tree and each other, have a much larger less-sought space to forage in; and the tree enjoying a long period of luxuriant growth before it fall much into seed-bearing, acquires strength of constitution to thrive and increase for ages under this drain.

We are satisfied that cutting or fracture of the root-leaders, especially near the bulb, when they have acquired some size, is injurious to the extension and longevity of the tree, in pines and most kinds of hard wood; and that branch-pruning, as generally practised, is not less pernicious, first, by the derangement which the plant receives, from the regular connexion between the rootlets and their affiliated twigs and leaves being destroyed by the section, and afterwards from the distance between the manufacturing parts, the leaves and the sources of supply in the ground being unnaturally extended, especially when the stem is long, slender, and much denuded.

Although we consider severe root fracture at planting pernicious to some hard wood and resinous trees, yet there are kinds to which it is advantageous. All plants which grow freely by cuttings, strike better to have the roots pruned in near to the bulb. Many kinds of seedling-plants also strike sooner, and throw out stronger new root-leaders, when the long straggling fibres are cut in a little, similar to the branches above, which, when over-numerous and slender, throw out more vigorous shoots by being cropped at planting.

PLANTING.

In regard to planting, soils divide into the *dry* and the *moist;* the former require to have the plants put in as soon as possible after the leaves drop off—at any rate, not to allow February to pass without completing the planting; excepting evergreens, which should not be delayed beyond the middle of April. In dry soils, if the expense be not limited to a very low rate, pit-planting should be adopted, and the pits are better to be dug some months previous, in order that the earth may be aërated, and the turf partly rotted. The moist soils may be divided into those which are much disposed to throw the plant from the frosts and thaws, and those which are not; the former consisting of moory, soft, or spongy earth, upon a retentive subsoil; the latter, of the firmer, more equable loams, clays, and tills. Unless the plants are large, they should always be slitted into the former soil, and the work performed as soon as the ground becomes saddled in spring—as, though the lateness of planting should preclude throwing of pitted plants the first season, they will often be thrown the ensuing winter. When plants are very small, they may be put into the latter, by slitting; but if middle-sized, or large, they are better pitted. It is of the greatest importance to these moist soils, to have very deep, open * drains executed previous to planting, cutting off all the springs at their sources, and, if possible, drying the subsoil to such a degree that water will not stand in the pits. Should this be

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* Covered drains are not adapted for woods, as the matted fibres of the roots, especially of the semi-aquatic trees, very soon enter them and form obstructions.

accomplished, it is highly advantageous to dig the pits in time for the excavated clay to have its cohesion broken by frost: the planting should afterwards be performed exactly at the time when this frosted mould is sufficiently dry, and no more, to shake conveniently in among the fibres of the roots, and not to knead into mortar, by the necessary pressing of the feet. After this pressure, a little of the tenderest of the soil should be spread loose over the surface, to exclude drought. Should this dryness of subsoil not be effected, the pits must be dug in spring, at the time the clay is most friable; that is, between the moist and dry; and the plants put in immediately, breaking the clay as fine as possible, and closing it well around the roots. It is better to delay planting even till May, than to perform it too wet. When planting is delayed late in spring, the plants should be kept *shoughed* in the coldest situation that can be found, at the top of a hill exposed to the north, or in some cold, damp, back-lying place. Care should also be taken not to expose them much while planting, as they, especially if the buds be bursting, very soon wither when root and stem are both exposed to the sun and dry air. When late planted, they ought always to be dipped as far up as the branches in a puddle of clay and water:

should they be dipped over head in the puddle, it will not injure them.

What is of most importance to the success of planting, is to have the soil put very closely in contact with all the root-fibre, and these fibres in due natural separation, with a little tender mould on the surface;—not to have water stagnating around the root, at any rate during the first spring;—to have the planting done in time, to receive a good sadding by rain before the spring droughts commence;—to prevent rank weeds, furze, &c. from smothering the young plants;—and to exclude or destroy all bestial, as cattle, sheep, rabbits, hares, mice, &c. In keeping the latter in check, a few families of foxes are very efficient.

FURTHER OBSERVATIONS ON PRUNING.

EVERY forester is aware, that when feeders are pruned off, they should be cut away as close as possible to, and without tearing the bole. To perform this without danger of injury to the tree, when feeders of considerable size are to be removed, the branch should first be sawn over at about one foot beyond the intended section, and a second section then performed at the proper place. This requires a little more time, but not nearly so much as an inexperienced person would suppose, as the section a foot out is made very quickly, and the pruner generally takes as much time to reach the branch as to cut it off. The neatness and advantage of this method will be acknowledged by those who have seen it practised, to compensate for the longer time it requires.

We find the saw, shears, and knife, the best instruments for pruning; in some cases of difficult approach, the long-handed pruning-iron may be resorted to. When the lopping is performed by a percussion tool, the wood and bark at the section is often shattered by the blow, and thence is less likely to cicatrize soundly; and even when executed in the best manner, the surface of the section is smooth and hard, consequently a good conductor of heat, dries much, and thence shrinks and cracks near the centre of the cut, opening a deep crevice, into which the rain penetrates, and often rots deep into the stem. When the section is made by the saw, a slight fibrous clothing is left upon the place, which in some measure protects the ends of the cut tubes from the frost and drying air, and excludes the heat; in consequence the wood at the section does not lose its vitality so far inward, and is not so liable to shrink and crack in the centre and receive rain. The section can also generally be made much neater and closer by the saw than by any other instrument. The common erroneous belief, that a section by a sharp-edged instrument is less injurious than by the saw, is merely hypothetical, from wide analogy from animals. The pernicious influence on the whole individual, received and transmitted by the nerves from mangled section of animal fibre, is probably entirely awanting in vegetables; the whole process of life and of cicatrization is also totally different.

The forester should also be very wary in cutting off a considerable branch, whose section would incline upwards, as such a section, when it has received a circle of new bark and wood, forms a cup which receives and contains rain water, which quickly corrupts the bottom of the cup, and often rots the centre of the tree down to the ground. It is better to crop such a branch several feet from the main stem, close by some small feeder, unless the branch be dead. In pruning, every considerable section should be as near as possible at right angles with the horizon, or rather inclining inward below. Of naval timber, the beech is by far the most likely to take rot by being pruned, and should never have a large limb cut off, as the divided fibres generally die downward a number of feet below the section, and soon afterward decay, leaving a hole in the bole.

As nothing retards the growth of trees more than full flowering and seeding, if pruning diminish this flowering and seeding, so that the gain from the prevention of this exhaustion more than counterbalances the loss of the pruned-off part, the pruning will of course accelerate the growth of the tree; but the removal of lower branches, although in the first place promotive of growing buds and extension of the top, in a year or two longer only tends to throw the tree more into flowering and seeding. The rich dryness, or want of fluidity of the juices which occasions flower-buds, is also induced by hot, dry atmosphere, and short supply of moisture from the roots during the preceding summer, both of which disposing causes are increased by a long naked stem. When the proportion of the part above ground of a tree to the roots is diminished, growing buds result, at least to a certain extent; yet it would be very difficult to practise a proper system of pruning on this principle, as the consequent lengthened stem is, in the end, promotive of flower-buds, especially in dry seasons, and the loss of feeders might greatly counterbalance the gain from not flowering, did a succession of wet cold seasons follow.

The season when pruning should be performed, is something dependent upon the kinds, whether they bleed when pruned in early spring or do not. Almost any convenient time will suit for pruning the latter, but we rather prefer March, April, May, June, or autumn after the leaf has fallen. The former, sycamore, maple, birch, &c. ought either to be pruned in autumn, or after the buds are beginning to break in spring, as they bleed and suffer considerable exhaustion when pruned in the latter part of winter or early spring. From some facts, we consider that pruning in winter, especially in severe weather, gives a check to the vigour of the tree; others agree with this.

OBSERVATIONS ON TIMBER.

THE quantity of measurable wood of the various timber trees which a certain extent of adapted ground will carry, when come to full maturity, or when they may be most profitably felled, and the quantity that may be thinned out during the maturing, with the time requisite to bring to value, with the relative selling price per foot, and also whether the greatest quantity of timber can be grown of one kind or mixed, are questions of more importance than might be judged, from the attention paid to the subject. Of our common timber trees, Scots fir, silver fir, and spruce, larch, pinaster, black Italian poplar, Salix alba, commonly called Huntingdon willow, red-wood willow, beech, Spanish chestnut, ash, plane, elm, birch, oak, are here ranked nearly in the order of quantity of measure which adapted ground in this country will produce or support; that is, that an acre of close Scots fir trees, of whatever age, will admeasure more timber than an acre covered with any other tree of the same size; and a close acre of oaks less. A little further south, in the temperate zone, the large-leaved deciduous trees, particularly the elms, acquire thicker and longer stem, in closer order, in a given time. In this country, in rich warm situations, this is visible in some degree, both as regards quantity of timber and quickness of growth, compared with pines. It would be difficult to state the comparative quickness of growth of the various timber trees, as so much depends on soil, situation, and treatment; it also varies considerably at different stages of their growth. It is well known, that in proper soil, black Italian poplar, Salix alba, and red wood willow, exceed all others.

As, for naval use, it is not the quickness of growth and bulk of the timber altogether, but of the matured timber alone, which is of consequence—we give a view of the number of growths or annual circles of sap-wood (the useless part), which the main stems of several kinds of trees presented. Most of those we examined had a greater number of sap-layers near the top than at a few feet above ground; and the vigorous branches had generally more than the stem immediately adjacent to them; the branches with least vigour had fewest sap circles.

Of Home Growth.

Common oak, some trees . . .	10,	others 14,	others 18
Spanish chestnut, ...	2,	5,	6
Scots elm, *U. montana*, . . .	16,	25,	32
English elm, *U. campestris*, . .	0,	10,	0
Red-wood willow, ...	8,	14,	0
Laburnum, ...	3,	5,	0
Wild cherry, *Prunus cerasus*,	16,	24,	0
Black Italian poplar, . . .	9,	0,	0
Scots fir, ...	20,	30,	40
Pinaster, ...	0,	10,	0
White larch, free of rot, . .	5,	12,	18

Of Foreign Growth.

Memel fir, ...	0,	48,	0
Red Canadian pine, . . .	0,	100,	0
Yellow Canadian pine, . .	38,	44,	0

The process of maturing in several did not proceed regularly, some of the rings being reddened on one side and remaining white on the other: this did not seem to be influenced by position to south or north. In the larch, particularly in those trees where the rot is incipient, this maturing is very irregular, in the view of the cross section dashing out into angles and irregularities, and being darker red than in the healthy plants: in those where rot had made considerable progress, the red-wood was within a circle or two of the bark. This approach of red-wood to the outside is so regularly connected with rot, that we needed no other indication of the roots being unfit for knees, and therefore not worth grubbing, than merely a slight notch by two cuts of a hatchet.

Those kinds of timber whose matured wood assumes a brown or reddish colour, are generally much less susceptible of change, either by simple putrefaction or by attack of fungi, or gnawing of insects, than those whose matured wood remains of a whitish colour. In many of the latter, there does not even appear to be any particular change of constitution, or greater capability of resisting corruption or insects, between the alburnum and mature wood, although the difference between the two is generally perceptible when the cross section is drying, and immediate, as in the brown or red; there being no gradual change or softening in either between the mature and immature. Although the change in those which become brown and red does not much affect the hardness or strength of the timber (mature and immature being nearly equal in these when dried before corruption injures the latter), yet it materially influences its nature or quality. We have taken down Laburnum trees in the round natural form from the roofing of an old building, from which nearly the whole yellow or sap-wood was eaten away by insects, although they had not made the least impression upon the brown *.

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* Laburnum (Cytisus) is the most valuable timber this country produces. It is equally deep in colour, and takes as fine a polish as rose-wood, having also something slightly pellucid in the polished surface. From its extreme hardness, it is much better adapted for use than mahogany, not being indented or injured by blows or rough treatment. We are acquainted with no other timber of home produce so little liable to decay. The large-leaved variety in rich warm soils acquires a diameter of a foot or a foot and a-half, and grows rapidly till it fall into seed-bearing. Its usual very stunted growth is partly owing to less valuable faster growing trees overtopping it: Were it planted alone, and trained to proper curve, it might be profitably reared for the upper timbers (the part where decay commences) of small vessels: it has the thinnest covering of sap wood of any of our timber trees. The extreme beauty and richness of its clustered depending blossoms is a considerable injury to its growth, as it is often broken and despoiled of the branches on this account. The small-leaved Laburnum, though producing the most beautiful timber, is of such puny growth as not to rank as a forest tree. There is a peculiarity, at least seldom occurring in other trees, attending the growth of the small-leaved variety: a branch frequently gives up feeding the connected trunk and roots, drawing supply of nou-

Whether timber be more lasting when cut at one time of the season than at another, is not yet determined. The matured wood does not seem to be much affected by the season, continuing nearly equally moist throughout the year; life or action in it, though not quite, being nearly extinct, and little or no circulation remaining; yet the matured wood of the stool of the pine throws out a little resin when the tree is cut down in summer,—perhaps only a mechanical effect of heat and drying. Steeping in water for a considerable time is of far more importance to the duration of timber than any thing depending on the time of the season when it is cut down; steeping causes some acetous

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rishment from these upward, without returning much or any of the digested matter downward. This branch above the place of the stagnation of the bark vessels becomes enlarged, running into numerous shoots, which are generally unnaturally thick and unhealthy, approaching to dropsical—often, however, beautifully pendant down to the ground, from their weight and the smallness of the supporting branch. We do not know whether this is an awkward effort towards increase—that these branches, under the influence of a not entirely matured instinct or faculty, droop in search of earth to root, and extend by layers, in conformity to a habit of some tribes of trees, in which this mode of increase is efficient, or that it is a disease unconnected with design or final cause. These overgrown branches of the small-leaved laburnum are generally thrown out by trees, which, owing to circumstances, are little disposed to seedling.

change in the timber (easily recognisable by the sense of smelling when any section of it is made), which, judging from the effect the acetous change has to preserve other vegetable matter from putrefaction, is probably of considerable use in preserving the timber from decay, either by rot or worming. The time of cutting, although of considerable importance to the quality and durability of the sap-wood, appears to be of little or none to the matured.

The age at which timber may be cut down being uncertain, the height to which it should be trained up of clear stem is not very determinable,—say that the trees are to be allowed to stand till nearly full grown,—as long as the timber continues to retain its strength and toughness when growing in proper soil, that is for hard-wood trees 100 years and upwards, and for pines from two to three hundred. On crowns of eminences and exposed bluffs, particularly when the latitude or altitude is rather high, the soil inferior, or the climate arid, from 15 to 30 feet of clear bole may be as much as can judiciously be attempted; upon plains under common circumstances, from 30 to 50 feet is an attainable stem; in sheltered dales and valleys, they may be trained clean, and without branch, from 50 to 70 feet in altitude; and in cases where soil, situation, and climate, are all propitious, and it is desired that nature's fullest, grandest, development should be displayed, from 70 to 150 feet, clear of branch, may be gained. Lewis and Clarke describe a spruce, in a sheltered dell on the river Columbia, which they measured, lying upon the ground, 312 feet long from root to top. We have little belonging to earth more sublime, or which bears home to man a deeper sense of his bodily insignificance, and puny transient being, than an ancient majestic forest, whose luxuriant foliage on high, seems of itself almost a firmament of verdure, supported on lofty moss-covered columns, and unnumbered branched arches,—a scene equally sublime, whether we view it under the coloured and flickering lights and shadows of the summer eve and morning, resounding to the song of the wild life which harbours there,—or under the scattered beams streaming downward at high noontide when all is still,—or in winter storms, when the wild jarring commotion, the frightful rending and lashing of the straining branches, like the arms of primeval giants, contending in their might, bear accompaniment to the loud roar and bellow of the tempest, forming a drone and chaunter to which demons might dance.

CONCERNING OUR MARINE, &c.

CAN we consider the Briton sane who speaks of bounding this country to her home resources? Can any one doubt that our name, our wealth, our power, are not wholly attributable to our *Marine?* Can any one be ignorant that the superiority of our marine is wholly dependant on our *foreign trade*, particularly the bulkier part of it, our *foreign supply?* Does any one dread the necessity of *foreign supply*, from the foolish fear that it may be cut off by war? Keeping out of view the argument, that ere the British pride would suffer *other domination on the waters*, our numbers would be well thinned away, they know little of the influence of circumstance on man, who do not perceive that, in the event of free trade, and of the population of Britain increasing beyond what the country, under the best possible culture, could support, the very necessity of being mistress of the seas would make her so. They know little of what Britain is, country and people, who doubt of her continued supremacy, should she not be ruined, indeed, by following the narrow selfish views of a party—a party alike ungrateful * for the past, and blind to, or heedless of, their own ultimate good. The position of Britain,—her stretch of sea-coast, serrated with harbours,—her minerals, the principle of mechanical motion, so necessary in the arts,—her navy, docks, canals, roads, implements, and machinery, so superior to those of the whole world beside,—her fertile soil,—her capital,—her protection of property,—her insular situation,—her steady government and consequent ingress of capital from the continent on any commotion,—her habits of industry,—her knowledge of trade,—her sciences,—her arts,—her free press,—her religion †,

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* Let us compare the wealth of the British landholder with that of the like grade on the Continent. It is the unrivalled skill and industry of our manufacturers and traders which have laid every shore under contribution for the immense riches which has poured in upon our landholders, and which, from juxtaposition, will continue to do so, in a certain degree, under the fullest freedom of trade. It is now absurd to talk of duties on foreign products, to counterbalance home taxation—taxation now bears lightly on home agricultural production, more so than in many parts of the Continent; and our manufacturers, under the same or greater taxation, compete with and outstrip all the world in cheapness of production.

† The dread of change in Catholic countries—the proscription of almost every new work treating of science—the complete submission of the mind to the religious authorities, bearded men "becoming little children" even to the letter—the consequent

—and the stamina and indomitable spirit of her people. All these, causes and effects combined, brought into action under a climate the most favourable for developing the moral and physical energies of man, where the extremes of temperature neither relax nor chill, where the human muscle and human mind are more capable of continued strong exertion, and machinery less influenced by hygrometric and calorific change, than on any other spot of earth. When all these are condensed into a nucleus of power of so small compass that one spirit, one interest, may pervade all, but drawing support by ramifications from every nook of the habitable world, should an infatuated party not render unavailable these unmatched advantages, cowardice could not even dream of peril to the supremacy of British naval power.

Let us continue to extend our foreign intercourse and home cultivation—let the merchant legislate in affairs of trade—the landholder in country matters; each in that in which his judgment has been formed by experience, acting always on the principle that the general prosperity of the country is the interest

general abandonment tosensual enjoyment—the immense number of holidays—and the shoals of meddling priests, are a great bar to improvement—an insurmountable one to manufacturing pre-eminence. We need not say that all this is subordinate to climate. Effect, however, soon turns to cause.

of every class—that, like the branch and the root, their prosperity is indissolubly combined.

When we view the advantages of Britain—almost to a wish,—when we view her able and ready to supply the necessities of man in every clime, in exchange for his superfluities, and to scatter science, morality, the arts of life, all that conduces to happiness and improvement over the nations,—when we view all this, being blasted by an exclusive system of monopoly, of very doubtful advantage to one party of the nation, and tyrannically oppressive upon all others, can we refrain from execration? We would desire the casuist to draw a distinction between the criminality of preventing the operative from exchanging the produce of his labour (otherwise unsaleable) for cheap food *, when his family is famishing; and compelling the labour of the Negro (whom you support with food) with the whip. Men will be found of a virtue sufficiently easy to advocate either system. We only wish that the supporters of

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* Our industrious operatives, rendered trebly more productive by recent machinery improvements, fabricate three times more commodity than our landed and other population can with their present habits consume. Few other nations can give else but food in exchange for this overplus; our landholders have enacted laws to exclude food, and our operatives are being starved down to the requisite number for home supply.

monopoly and their abettors were sent off to some separate quarter of the world with all their beloved restrictions, duties, tariffs, passports, revenue officers, blockade men, with the innumerable petty interfering vexatious regulations, and all the contrivances which surely the devil has invented to repress industry and promote misery, where they might form an Elysium of their own.

There is nothing more certain, should we by restrictions continue to banish knowledge, capital, and industry from our shores *, than that the Genius of Improvement will fix upon some other place for the seat of her throne. *Maritime dominion* will follow in her train; and on the first war, all exportation of the products of our manufacturers being at an end, unexampled misery will involve four-fifths of our population, and an explosion will ensue, from its origin and character of unparalleled fury, which will sweep to destruction the insane authors of the calamity—tear to shreds the whole fabric of society—and give to the winds all the institutions which man has been accustomed to revere.

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* The same polity under which Britain has acquired supremacy, will not now serve to continue it. A knowledge of the interests of nations is abroad, and if we will not suffer our country to be the emporium of the world, another will.

It is disgraceful that our MARINE is not directly represented in the British Parliament. Is it possible that every clown in England, who is owner of a few acres or miserable hovel, is carried to the poll,—and that our shipping interest, and brave seamen, to whom the rest of the nation is indebted "for all they have, and almost all they know," are passed over—have not one direct representative—have not even one direct vote, and that their interest is totally neglected*? Will it be credited that our most sage legislators, as if on purpose to ruin our marine, have laid on a tax of L. 4 per load (above 1s. 7d. per solid foot) on oak-plank, and L. 2, 15s. per load on rough oak-timber, imported from other nations; which, as only a small part of what is (not of what would be) used, is so derived, at the same time that it raises the price of the whole† nearly 100 per cent., tends comparatively little to swell the revenue,—nearly the whole of the high monopoly price reverting to our landholders and our grateful Canadian colony? As about a load (50 solid feet) of timber is required for the construction of a ton of trading shipping, this duty, together with the high duty on hemp, increases the cost of our vessels nearly L. 4 per register ton, independent of the higher price of building and sailing them, from other monopolies; and it is only from the very superior skill, honesty and industry of our seamen*, that our shipping, since the peace, under this very great disadvantage, has been at all enabled to compete with foreign. At Shields and Newcastle a new merchant-vessel of oak, rigged and ready for sea, uncoppered, can be purchased for L. 10 per register ton. Were the price, by the removal of monopoly, reduced to L. 6 per ton, scarcely a foreign bottom, American excepted, would compete with British, in the carrying trade, or would enter a British port. Can it be believed that our very liberal late minister (Mr Huskisson), and our very non-liberal member for Newark (Mr Sadler), have both made a *full* exposè of the distresses of our shipping interest, and not once have adverted to the *cause* of this, and of the comparative decline of our naval preponderance—*the very high duty on the*

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* See App. E.

† The price of any article raised at home, when any part requires to be imported, of course rises to the whole cost (prime cost, duty and freight) of the foreign.

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* The chance of loss by wreck, damage from sea-water, and pilfering, being much less in British than in foreign bottoms, enables the British to obtain a higher freight than the foreign.

material? Does our Government perceive the rapid strides which our rival brothers in America are making to surpass us in marine—and will it be so besotted as continue laws to the speedy fulfilment of this?

May we hope that, through the energy of OUR SAILOR KING, Britain will lead the van in the disenfranchisement of man from the old bondage of monopoly and restriction—that a more sane system of taxation (a tax on property) will be adopted, as well as a necessary retrenchment—that the true interest of Britain will be understood and followed, and a new era begin. We are sick of the drivelling nonsense of our closet economists about loss by colonies and foreign connexion. Bonaparte well knew the value of SHIPS, COLONIES and COMMERCE, and dreaded the power which eventually wrought his fall. The existence of China depends upon her Agriculture, and the sovereign devotes a part of his time annually to the plough. The existence of Britain depends upon her Marine, and the king should always be bred a sailor—the heir-apparent and presumptive being always sent to sea. In the case of a female, if she did not take kindly to the sea-service, a dispensation might be allowed, on her marrying a sailor, and the foolish law prohibiting our Royal Family from marrying a Briton be put aside.

PART IV.

NOTICES OF AUTHORS RELATIVE TO TIMBER.

AFTER throwing together several of our own observations, we bethought ourselves of examining into the ideas and experience of recent writers on the same subject. Having taken notes of the more prominent matter contained in their pages, we believe we shall do the public a service by printing these notes, accompanied by slight remarks. This may be the more useful, especially as almost every author has his own particular mania, which few common readers have sufficient knowledge of the subject to discriminate from the saner matter: and as, from the nature of hobbies—from some shrewd enough guesses by the owner that they are his own undoubted property—and, perhaps, from some misgivings, that what he advances on these is not perfectly self-evident, he is thence the more disposed to expatiate upon them, and embellish. The credulous and inexperienced, partly from this, and partly from the fascination of the very improbability, rush at once into the snare; bring the speculations or assertions to practical test; get quickly disenchanted by realities, and ever after are disposed to treat all written directions on material science with contempt. We bring forward these authors in the order of perusal. We have found several remarks similar to our own; this was to be expected.

1. THE FORESTER'S GUIDE, *by Mr Monteath.*

THIS volume is the work of a man of some experience, and of considerable observation and ingenuity, not much assisted by botanical or physiological science or literary attainment, which he, indeed, disclaims. His principal forte, and what he seems to have been most engaged with, is oak-coppice—his besetting sin, cutting and cropping. His directions on rearing and cutting coppice may be sensible;—those who wish to practise the sacrilege of destroying young oak-forest, we refer to him, as we have always had a horror at seeing a beautiful sapling untimeously cut down, like an American bullock for its hide. At present, and while peace continues, it is very easy to obtain plenty of foreign bark, and also oak-timber, for consumption, at a very cheap rate, for this reason—*and also, because, in the event of war, the price of these articles would be nearly doubled—we would request the holders of coppice, and, indeed, of all growing oak-timber, to pause in their operations of cutting, and not to sacrifice their property so unprofitably, to their own ultimate disadvantage, and also to the detriment of* *the national resources; but immediately to set about converting their coppice-hags into oak-forest, by careful thinning and selection.* For performing this, we refer them to Mr Monteath in person, who seems to comprehend the utility, and to be pretty well versed in the practice, of thinning; only we would desire him, in pruning, to attend to the functions of the leaves; that the more abundant the covering of healthy foliage, the tree will progress the faster; and that the repeated cutting down of a young plant, year after year, as he recommends, even sometimes extending it to five years in succession, will either destroy the plant altogether, or be extremely injurious to its growth: although, if the plant be stunted, cutting it down, once, as every body knows, is the plan which should be adopted with all kinds of our common forest trees—the coniferæ, beech, and birch, excepted.

Mr Monteath advises a naturalization of young plants, after they are got from nurseries, in a soil and climate similar to that which they are ultimately to occupy. We see no necessity for this. All that is required in a young plant, is, that it be of good variety, of firm fibre, in a healthy growing state; with a stout stem, in proportion to the height, with numerous side branches, and with a root rather large in comparison to the part above ground.

Our author's mode of preparation of turfy peat-moss soils for planting we think good, but conveniently applicable in heathy moss ground, only with the assistance of the late Mr Finlayson's ingenious device of the self-clearing plough. At every seven feet of breadth, Mr Monteath excavates a deep rut, by means of a plough with three coulters and two mould-boards,—two of the coulters cutting, each, a side of the rut, the other dividing it in the middle, and the double mould-board turning out a furrow to each side. He passes this plough twice along in forming the rut, each time turning out from four to six inches in depth, so that the whole depth of the rut is about ten inches. These minor drains communicate with larger ones dug by the spade across the field. The thrown up slices are then cut into lengths of eighteen inches, and carefully dried, by turning and by piling a few together, as openly as possible, that the wind may blow through. A small pile, about six in number, is then burnt upon the intended site of each tree, if necessary, aided in the combustion by furze or other fuel; taking care, by proper regulation of the quantity of fuel, or otherwise, to prevent the combustion from proceeding too far, and the ashes from becoming white and light, as in this case a considerable part of their virtues is dissipated. This ploughing, drying, and burning, being performed as early in the summer as the weather will permit, the earth under the ashes is immediately dug over, from two to four feet in breadth, and mixed with the ashes, and the following spring the planting is performed. In situations where Mr Monteath's plough could not be worked to advantage, these minor drains may be formed by the spade; and in heathy peat soils, not requiring drains, the burning of the heathy turfs on the site of the plants might be efficacious in correcting the tannin, and in reducing and enriching the soil within the immediate reach of the young plant, which would thus acquire strength to subdue the more distant part, and gradually reduce and form the whole into soil capable of affording healthy nourishment.

We also approve of the plan mentioned by Mr Monteath, for covering with timber, rocks or stony ground, so bare of soil as not to admit of planting, by means of placing seeds in the crevices, or on the shelves of the rock, and scraping together a little mould to cover them; or, when practicable, placing the seeds in the middle of the mould. Here, however, we think he errs, in recommending the cutting down of the young sucking shoot, year after year, that the plant may acquire long roots, extended down the crevices, to give the future stem stability and sufficient foraging. We would never cut down but when the plant appeared stunted, and not then in succession, nearer than three or four years from the last cutting. Those who possess rocky precipices, so steep or inaccessible that the above method of our author could not be practised with conveniency, may cause a quantity of the cheapest seeds of trees be sown down over the top of the crags during the winter: we would prefer the end of January, as the mouldering effects of the frost and the rains would cover numbers of these, so as they would come to vegetate.

Mr Monteath advises, in rearing oak-forest or copse, to put in only about thirty plants per acre, and by layers from these to cover the interstices. In order to recommend this practice, he states the celerity with which these could be extended, layer beyond layer, making steps, every second season, of eight or nine feet, by relaying the last layer's shoots, and he affirms, that a forest could be sooner, and more economically raised by this means, than by planting the whole at first. This is sufficiently imaginative. He seems not to be aware of the fact, that life is very languid, and growth slow, in any branch horizontally extended, especially when upright stems from the same root are suffered to remain. He also expects the layer-roots to become strong and capable to forage for large trees. That they will, in the oak, ever become so, we think very improbable. Examination of the roots which proceed from oak-layers would place this beyond dispute; if they are, as we presume, fibrous and slender, similar to those produced by apple-layers, no tree or bush of any great size will result. Large trees, generally, cannot be procured by layers, but only in those semiaquatic kinds which grow readily by slips. Whether it may be advantageous to fill up the vacancies of copse by layers, in preference to seed-plants, experience only can determine. The bark of trees or bushes raised by layers or cuttings is generally thicker than that of those raised from seed:—this might balance some deficiency of the growth in the case of oak-coppice.

Our author advises the cutting off the upper part of spruce-trees on the outside of plantations, in order that their lower branches may extend the more, and remain vigorous,—thence affording more adequate shelter to the within plantation. Perhaps it is quite unnecessary to guard any person from practising this piece of folly. On the outside of woods, spruce-firs will retain the branches in vigour, sufficiently low for all the purposes of shelter: nothing could be more unseemly than the decapitated trees; and in a few years most of them would become rotted in the stem, die, and fall down.

From observing, on the western side of Scotland, thriving plantations exposed to south-west winds and sea-spray, and also to north-east winds and sea-spray, in woods extending along the western side of the salt lochs in Argyllshire, our author predicts, that, under his panacea of repeated cutting down, trees would grow luxuriantly in exposed situations on the north-eastern margin of our island. We do not desire to see Mr Monteath's sanguine hope turned to disappointment, which a trial would certainly effect. There is something peculiarly hard and cutting in our *vernal* north-eastern breeze fresh from ocean, which withers up the tender spreading leaves of every plant raised from the ground, and placed in its immediate draught. This is occasioned as well by a cold moist, as by a cold dry wind, the new vegetable structure in the developing process, when the tissues of tubes and cells are only in the state of pulp, and all the molecular germs floating into figure, under the direction of vital and chemical impulses and attractions, being very susceptible of derangement. We attribute this effect on vegetables principally to the coldness and saline matter. The depressing effect on the spirits or vital energy of man, occasioned by the eastern breeze, does not appear to be dependent on the same cause. The great rivers, the Rhine, the Weser, the Elbe, independent of the English rivers, throw a great quantity of decaying vegetable matter into the lower part of the German sea, which, being there only a shallow muddy gulf, may thence have its waters so far contaminated as to throw off pernicious exhalations. Or, what is much more probable, the eastern breeze, sweeping along the swamps (at this time in high evaporation, of malaria) which extend from Holland upward, and along the whole southern shore of the Baltic, and thence eastward nobody knows how far, must bear these exhalations, uncorrected, over the narrow sea which intervenes between these flats and our shores. It is even likely that a slight diffusion of saline matter from this gulf, instead of correcting, may have the opposite effect, as a small quantity of salt tends to promote putrefaction. It is evident that this miasma-atmosphere, borne across the German sea, is not pernicious to vegetables; as, when the breeze is not too cold, or too violent, they progress rapidly in growth, and acquire a deep green colour: and, on the north-eastern Scotch coast, where timber suffers most, the breeze has little of that depressive influence on man, although it may derange his respiratory and transpiratory organs; while down on the shores of Suffolk and Essex, where the malaria of the breeze is greatest to man, the exposed trees receive less injury. Yet something may depend upon the electric state of this air, or upon the greater pressure of the atmosphere, which, we believe, are connected. On the exposed east coast, when it is desired to grow timber, we must estimate the most enduring kind of tree, perhaps sycamore plane, and place it to seaward, covering it as much as possible by wall, and planting other kinds under its lee. We have noticed several instances where timber throve well, without shelter, close by the sea, on our north-east coast, which we attributed to a diminished draught of the eastern breeze, owing to the configuration of the adjacent higher country.

Mr Monteath ascribes the sickliness and decay which, in many places, is perceptible in the timber of narrow belts, to the want of shelter, and recommends to form belts wider. There is some truth in this, and the advice is good, although he does not seem to be aware of the whole cause of the evil.

Trees in single rows thrive latterly much better than in narrow belts, because, from the planting, they are habituated to open situation, and acquire roots, branches, and stem, suited to this: whereas trees in narrow belts, from being in a thicket while young, acquire great length of stem, and roots and tops unproportionably small; and, when thinned out, and from the narrowness of the belt, exposed nearly as much, as, though in single row, they become sickly, from delicacy of constitution unsuited to this exposure, and from deficiency of roots to draw moisture commensurate to the increased evaporation. To obviate this evil, resulting from narrow belts, timely thinning, so as to retain numerous side-branches downward to the ground, of course, should be adopted. In a drier climate, or in high and exposed situation, continued forest will have great effect in promoting the luxuriance and health of timber; but in the southern part of Scotland, there are few situations, keeping away from high elevation and the eastern coast, where any of our common trees would prosper in forest, which would not grow pretty well singly, provided the plant be allowed from the first to accommodate its figure to the situation.

Mr Monteath's system of pruning severely while the trees are young, we think very prejudicial; and his restricting pruning to trees under 15 or 20 feet in height, equally erroneous. About 15 years ago, we selected a number of young trees several years planted, and low and bushy, in an open situation. We treated one half of these in a manner similar to what our author inculcates, pruning away most of the lower branches, and also any irregular top ones: and the other portion, though very bushy, we left to nature's own discretion, merely correcting several which threw up more than one leader. The result has been, that those much pruned up have required constant attention to the top and repeated pruning, they continuing to break forth into irregular branches and numerous leaders, and thence have sustained considerable loss of growth; while those let alone, after hanging several years in bush fashion, of their own accord have thrown up fine leaders, which now form beautiful, upright stems, with sufficiency of regular lateral branches or feeders, requiring little or no attention; while the original bush at the ground, from the size and overshadowing of the superior tree, appears now so diminutive as to be unworthy of notice. We do not mean to inculcate that pruning is superfluous; on the contrary, when judiciously executed, under regulation of the purpose for which the particular kind of timber may be required, it is highly useful: but the cutting off and diminishing the number of lower feeders, thence deterring the growth of the tree, and encouraging the superior feeders to push up as leaders; or to increase in size so as to render their removal, should it be necessary, dangerous to the health of the tree, and the upper part of the stem useless from large knots (a practice which in nine cases out of ten is followed), cannot be sufficiently reprobated. *In pruning, every means should be taken to increase the number of feeders*, in order that none of them may become too large; and no healthy regular feeder should be lopped off till the tree has reached the required height of stem, and a sufficient top above this for the purpose of growth; at which time the feeders upon the stem, as far up as this necessary height, may be removed *.

Mr Monteath states that Scots fir should not be thinned to greater distance than 20 feet apart, and larch 15 feet. This shews very little consideration: the distance apart necessary for these kinds of timber, and of all other kinds, must be relative to the soil, situation and climate, and the intentions of the owner, whether he means to bring them soon to market, or carry them forward to great timber. When fir trees are intended to be early cut down, or when disease in larch from unfitness of soil may be apprehended, as it is thence of small consequence though their future ability to become great timber be destroyed by closeness, the plants should be retained pretty near each other from the first, that the timber may be tall, straight, and clean. On the other hand, when the soil is suitable and great timber intended, early attention to thinning and great openness from the first is absolutely necessary, as they (the firs), different from other trees, can never repair the loss of their lower branches by throwing out new ones from the naked stem ; and double the distance stated by Mr Monteath at least for larch, which, instead of less, needs more space than Scots fir, will be required. We believe the decay of Scots fir, occurring so generally at about 40 years of age, although also dependent on inferior variety and kiln-drying of cones, arises principally from want of timely thinning ; that is, that the infirm variety of Scots fir in common use, when supported by numerous feeders, and not weakened by being drawn up into a tall slender stem, will often have hardihood to continue growing, and acquire considerable size in our cold, wet, moorish tills, or even in our moorish sandy flats. Many casualties will, however, occur among resinous trees *, especially in unsuitable soil, even when the plants rise from the seed naturally sown, and have sufficient room for lateral expansion. The same cause, viz. closeness or want of thinning, induces early maturity, old age and decay in larch, although it does not seem to have any influence, either as inducement to, or prevention of, the rot. We have heard men,—even men reasonable on other subjects—speak of allowing a pine wood to thin itself: as well might a farmer speak of allowing his turnip field to thin itself. When woods are planted of various kinds of timber, the stronger, larger growing kinds will sometimes acquire room by overwhelming the smaller: but when the forest is of one kind of tree, and too close, all suffer nearly alike, and follow each other fast in decay, as their various strength of constitution gives way; unless, from some negligence or defect in planting, a portion of the plants have come away quickly, and the others hung back sickly for several years, so that

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* This repetition of our directions on pruning is intentional.—"Carthago est delenda."

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* The coniferæ have a weaker or more connected vitality than most other trees—the whole individual participating in the injury of any part. Perhaps this arises from the liability of resinous juice to putrescency—any putrid affection in one spot of the more vital part of the tree spreading quickly over the whole.

the former might master the latter: or when some strong growing variety overtops its congeners. In the natural forest of America, when a clearance by any means is effected, the young seedlings, generally all of one kind, spring up so numerous, that, choaking each other, they all die together in a few years. This close springing up and dying is sometimes repeated several times over; different kinds of trees rising in succession, till the seeds in the soil be so reduced as to throw up plants so far asunder as to afford better opportunity for the larger growing varieties to develope their strength; and, overpowering the less, thus acquire spread of branches commensurate to the height, and thence strength of constitution sufficient to bear them forward to large trees.

Mr Monteath, apparently to encourage the destruction of young oak, and keep his merciless hatchet agoing, asserts that "oak trees, at the age of 24 or not exceeding 30 years, have as thick a rind or fleshy part of bark, as when they arrive at 50." If by this he means to say, that the useful part of the oak bark of the stem of a tree at 50 years old is no thicker than that of one of 30, we say he is wrong, widely wrong. A thriving oak tree of 100 years will still continue to increase the thickness of the valuable part of the bark on the stem, although part of the outer layers or cuticle may lose vitality, and become *corky*. We have taken down a luxuriant growing oak, exceeding three feet in diameter, the living bark of whose stem was about two inches in thickness, resembling thick plank, and which was considered by the tanners much stronger in quality than bark of younger growth. Has Mr Monteath seen any bark resembling this on 24 years old sproutings? If, by the above quotation, our author means to say, that the valuable part of the bark on the branches of a tree 30 years old, is equal in thickness to that on the same sized branches of a tree at 50, we say he errs still; that is, provided the older tree be in a healthy thriving condition, and growing equally open and exposed as the younger. Trees, as they increase in years, increase also in the thickness of the living bark, from the root upwards to the smallest twig, provided they have not begun to get dry and sickly from over maturity. When this period arrives, the living part of the bark upon the stem and larger branches becomes very thin, with a great proportion of dead corky substance; although, on the twigs and smaller branches, it still continues to thicken. The age at which the external part of the bark begins to lose vitality, is considerably dependant upon luxuriance of growth, climate, and exposure; and the period when this loss proceeds faster than the annual increase within, is altogether dependent on the vigour of the tree, not on the age, and never takes place till the timber is ripe for the dock-yard.

We would warn the readers of Mr Monteath's volume, that his calculations and statements regarding the worth of coppice and timber generally, seem more suited to flatter the owner's wishes than to be useful to him as a merchant; or to be adjusted to the value of money during the late war—not to the present value. We also do not very well comprehend his re-establishment or resuscitation of life in dead trees. We observe several other slight errors, such as the duration of his paling,—and the affirmation that the sap-wood will not extend so as to cover over the section of a pruned branch which contains any red or matured wood. Most readers will be able to detect such errors as these.

In taking leave of Mr Monteath's volume, we would offer our acknowledgment for the attention he has bestowed on the subject of the seasoning of timber, by steaming with extract of wood (pyroligneous acid) and by scorching, as prevention of dry rot. The greatest objection we see to his plan is, that all timber dried quickly is liable to crack and split, and loses a considerable portion of its toughness and elasticity; at least, timber when dried slowly is harder and stronger than when dried quickly, the dryness in both cases being carried to the same extent. The comparative strength of timber scorched and timber not scorched, after both are soaked in water, as in the lower timbers and plank of vessels, should be subjected to experiment.

Our author's directions (although the practice is also not new) to season larch by peeling off the bark one or more years previous to cutting, in order to prevent it from warping or twisting in framed housework; and his hints recommending stripping off the bark from most kinds of timber a season previous to cutting, are also deserving of notice. We greatly wonder that something efficacious has not been done in regard to dry rot by our Navy Board, and consider the subject of such importance, that we think a rot-prevention officer or wood physician should be appointed to each war vessel from the time her first timber is laid down, to be made in some shape accountable if rot to any extent should ever occur; and that this officer should be regularly bred to his profession at an institution established for the study of this branch of science at the King's largest building yard. Perhaps it might be as well to endow several professors' chairs at the universities to follow out and lecture on this science, as being of far more importance than many which are already endowed. We think that steeping in fresh water pits for several years, till a kind of acetous fermentation take place in the timber, or till it become of a blue colour; or in tan-pits; or for a shorter period in strong brine pits; or even salting the timber like herrings, after it is blocked out; or forcing pyroligneous acid, or composition of chlorine, or other solution, antiseptic or obnoxious to life, into the pores of the timber when dry, by pressure; or perhaps by charring the timbers after they are cleaned down on the stocks ready for the plank, by playing on them a jet of flame from a flexible gas pipe,—might, some of them, be found preventive of the rot, and at same time not to impair any of the valuable qualities of the timber.

We are a little shy in committing ourselves, lest we should be impressed as a dry-rot physician or professor; but if the following plan for preservation of vessels when unemployed has not already been tried, we recommend it to the notice of our Navy Board.

Let every part of the vessel be cleared out, and every port-hole or external opening be made as air-tight as possible.

Let a quantity of recent-burned limestone (lime-shells) be spread thin over every inside deck or floor, and over the whole bottom and sides of the vessel, and every door or hatch in the main-deck be immediately closed down air-tight. A number of rods or shreds of timber would require to be nailed slightly to the inside skin of the ship where the slope is considerable, in order that the lime-shells may rest and not roll down.

As soon as it is found that the lime-shells are completely slaked—become hydrate of lime—let it be sold to the farmer or house-builder, or be used in any government erection going forward at the time; and let another quantity be laid in. We would consider a sloop of 80 tons load of lime, value, prime cost and freight, about L.70, would suffice for covering the internal surface of a seventy-four gun ship. When slaked to powder, the lime might be disposed of at little loss. It is impossible, without trial, to say how often the lime would require renewal, but we think twice or thrice a-year would suffice to preserve the vessel dry and free of any corruption; perhaps even once might be found effectual. Suppose that the lime was renewed every four months, and that when slaked it only sold at two-thirds of the whole cost, the preservation of a line-of-battle ship would be nearly as follows. The price of the lime and work is correct, according to the rates in most of the harbours of Scotland.

A quantity of rods or shreds of timber, about three inches in diameter, for nailing on the sloping sides of the vessel, material and labour,	L.20	0	0
Eighty tons lime-shells = 560 bolls, at 1s. 7d. per boll, prime cost,	44	6	8
Freight of 560 bolls, at 1s.	28	0	0
The slaked lime is supposed to sell at 2-3ds of the cost, thence the whole loss on a year would equal the value of one cargo.			
Carrying three lime cargoes of shells aboard, and spreading them,	30	0	0
We allow here for the greater distance of carriage, and spreading out of the cargo, nearly thrice the sum requisite to remove lime-shells from a vessel into a cart.			
Removing the slaked lime of three cargoes,	30	0	0
Cost first year,	L.152	6	8
Deduct rods,	20	0	0
Cost, second, and each following year,	L.132	6	8

The complete efficacy of lime-shells in preventing dry-rot is already proved—the coasting small craft frequently employed in the carriage of lime-shells not being liable to it. All that requires to be ascertained, is the minimum quantity which will effect it; and if the expense of this quantity will greatly exceed the average loss by dry-rot in our unemployed shipping. If the quantity necessary be not greater than what we have supposed—even Mr Hume himself would not consider the expense extravagant—the preservation of a line-of-battle ship not exceeding that of one of our numerous army *captains* while lying *in ordinary*.

Lime is preventive of dry-rot in several ways,—when uncombined as an antiseptic, simply by drying, from its attraction for water; by its causticity, which remains for a number of months after it is slaked, destroying organic life; and by its absorbing putrescent gases. It is not easy, without trial, to form a correct estimate of the quantity of moisture which would enter through the inside planking of a man-of-war; but were the bottom of the vessel in good condition, the pumps attended to, and external air excluded, we should consider that the moisture would not greatly exceed 60 tons of water yearly, which would nearly be required to convert 240 tons of lime-shells into dry hydrate of lime. No very great injury or inconvenience would be produced by the opening of the seams of the ceiling (the inside skin), or of the inner decks or floors, or by the warping of the plank, resulting from the contraction of the timber by the dryness; but the caulking of the main deck would require to be looked to.

No danger from fire need be apprehended, from the sudden slaking of a thin layer of shells, even though a leak in the main deck should occur. The thickness beyond which shells could not be suddenly slaked upon dry boards without danger of fire, might be tried.

It is necessary to mention, that, though lime-shells, or dry hydrate of lime, when timber is so dry as to be liable to corruption by insects or by dry rot, is, by destroying life and increasing the dryness, preventive of this corruption; yet lime, in contact with timber for a considerable time in very moist air, from its great attraction to water, draws so much moisture from the air as to become wet mortar or pulp, which, moistening the timber, promotes its decay by the moist rot.

II.—NICOL'S PLANTER'S CALENDAR.

THIS volume, which ought to have been named Sang's Nurseryman's Calendar, is a work of very considerable merit and usefulness, where the craft of the common nurseryman is plainly and judiciously taught. The editor, Mr Sang, admits that he was very little indebted to the notes of his friend (the late Mr Nicol) for the matter of the volume; and the work itself bears evidence of this, being principally devoted to the operations of the nursery, the sowing and planting of hard-wood trees, which are described with a judgment and accuracy attainable only by long experience in that line, to which we understand Mr Sang belongs. Every person engaged with the sowing, planting, or rearing of timber, if he be not too wise or too old to learn, should forthwith procure this volume.

Mr Sang recommends sowing of forests in preference to planting, which many before him have done, we believe, more from conjecture that nature's own process must be superior to any method of art, than from any experience of the fact or accurate knowledge of—at least without giving sufficient explanation of, any cause rendering the tree of more puny growth in consequence of being transplanted. In the case of simple herbaceous vegetables, we find, on the contrary, that transplanting increases the size, protracts the period of full development, and retards the decay, the individual suffering no lasting injury from root fracture, or that injury being more than compensated by change to a new and more recently wrought soil; or even the root fracture, instead of being of prejudice to the growth, by throwing the energy of the plant in this direction to repair the injury, not only may do so, but delaying the superior process towards reproduction *, may also give a

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* Transplanting having an opposite influence on the young of herbaceous and woody vegetables, in the former when not already rising into stem, retarding, and the latter accelerating or furthering development of the reproductory parts, is a good lesson to reasoners from analogy. The root-fractured herbaceous plants repairing the injury almost immediately, and before the rudiments of the reproductory parts have time for expansion, the greater quantity of moist nourishment afforded by the unsought newly stirred soil, produces a flush of radical leaves, which react to further the extension of the roots. The new rootlets have again more connexion to promote the growth of the radical leaves, and to induce offsets—*tillering*—from the sides of the bulb, than to nourish or mature the core part, from whence the stem arises —a certain comparative extension and maturity of the core being necessary to the rising of the stem. Thence seeding can be retarded, and life in annuals be continued, *ad libitum*. On the contrary, in

new vigour to the soft fibrous rootlets, and greater extension than they otherwise would have attained. But in regard to some kinds of compound plants of perennial stem, transplanting, especially when the plant has attained some size, by fracture, throws the main wide diverging roots into numerous rootlets and slender matted fibres, none of which has individual strength to extend as a leader far beyond the shade of the spreading top, thence forage in a drier, more exhausted soil, and, from consequent want of supply of moisture, the sap of the tree stagnates into flower, or merely leaf-buds, instead of flowing out into new wood. The fibrous softer rooting vegetables sustain no lasting injury from root-fracture and transplanting; but the harder, more woody, larger growing roots, losing their leader, never entirely recover their original power of extention. Yet we think that one or two year old plants, taken from the seed-bed, would suffer little or no injury from removal, as the *tap-root*, which is ultimately of no consequence, never constituting a leader, but eventually disap-

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woody vegetables of perennial stem, the reparation of the root-injury takes place slowly, and the evaporation from the stem and elevated branches and leaves exhausting the little moisture afforded by the inadequate root-suction during an entire season, gives time and bias for the germs to pass into reproductory instead of productory organs even the first season.

pearing, is the only part which suffers fracture in the woody state; and the side shoots, which become the grand root leaders, are in the fibrous state, which easily repairs small injury. These observations refer only to certain kinds of timber trees. The willows, poplars, and lindens, succeed better when their roots are cropped in near the bulb when removed. We planted a piece of trenched ground, partly with poplar plants, with good roots, from a nursery, and partly with poplar loppings, about the same size as the plants, stuck into the ground: the loppings grew more luxuriantly than the nursery plants. The same occurs with willows—with this difference, that willow-loppings do better with the top entirely cropped, without any twigs or external buds; the poplar only pruned a little, with a terminal bud left on every twig, especially on the top shoot. The superiority of the growth of those without roots, results from their having fewer buds and twigs to exhaust the juices before the formation of new fibrils to draw from the ground, these few buds thence continuing to push more strongly, and from the roots growing more vigorously when sprung anew, than when they are a continuation of the wounded deranged old ones.

New rootlets spring out much sooner and more boldly from the thick vigorous green stem bark, than from the delicate tender root bark, and also more vigorously from the bark of the bulb than from the bark of the remote roots, of those soft-wooded trees; indeed, it appears to be owing alone to the great strength of the vitality of the bark of the stem, that those kinds are so capable of continuation by cuttings. The roots have nearly the same delicacy of those of other kinds of trees, and show no particular readiness to throw up sprouts when bared.

Mr Sang, in furtherance of his advocated scheme of raising forests *in situ* from the seed, sensible of the general impracticability of fallowing or working the ground all over previous to sowing, gives directions for pitting or stirring the earth the previous spring and summer, in spots about fourteen inches square, and from six to nine feet separate, burying the turf under the soil, in order that it may be rotted, and a fine friable mould obtained for reception of the seeds to be sown the following spring; several seeds are then deposited in each spot, equidistant; these require to be hand-weeded the first season, and the resulting plants hoed around for several successive years, till they have mastered the weeds, after which they are all plucked out but one (the most promising) in each spot. This is all very well, if we could have patience and assiduity to proceed thus systematically; and if the mice, birds, and other enemies, would "let them be;" but although this plan, when a braird is obtained, and the tufts cleaned, and seasonably thinned, is probably the best, yet landlords, in general incapable of exertion, but under the excitement of a fresh thought, are so infirm of purpose; tenure of life and property are so precarious; and trusted servants, especially when the procedure has originated with another, are so liable to be negligent, that our amateurs ought to gratify their passion for improvement while it lasts, and proceed at once by purchase of plants, and pitting or slitting, which procures them a forest immediately palpable to view. There is no doubt, however, that wooing the soil to kindliness, rearing the infant plant from the germ, and superintending *a principio* the entire beautiful process of vegetable development, will afford a deeper charm to a patient lover of nature; and that the continued solicitude and attentions required during this process acting upon man's parental instinct, will excite an interest hardly to be felt towards a child of adoption.

A nursery gives such facility to the rearing of the plants, that, taking into account the greater chance of failure by sowing *in situ* than by planting, the latter practice will be executed for one half the expense of the former. Supposing that the progress, after twenty years' occupancy of the ground, be equal in both cases,—at which period, however, we think the transplanted would still have the advantage,—it would require a considerable ultimate superior progress in those sown, to outbalance the accumulating value of the extra expense. It is probable a combination of both practices might be advantageously followed—sowing the soils and situations most suitable, and transplanting the thinnings of these into the more exposed unpropitious places *. The matter, however, must, after all, be left to the test of experiment in a variety of soils and situations.

This volume, being principally a monthly detail of a nursery practice, which has supported the test of competition, has, on this account, a very different credit and value from much that has been published of landlords' practice, theorists' conjectures, or adventurers' quackery. The burthen of our author's song, which, from the nature of the work, falls to be repeated at several of the calendary periods, and which perhaps cannot be too often repeated, is nearly as follows.

Procure good seed of the best varieties from large healthy trees, and preserve these in husk in dry

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* We rather think Mr Sang mentions this.

well-aired places till sowing; with the exception of ash keys, haws, holly-berries, roans, and yew-berries, which require to be put in the rot-heap as soon as gathered. The rot-heap consists of seed mixed with sandy earth formed into a layer not exceeding ten inches in thickness; this is turned several times before midwinter, when it is covered with a layer of earth about seven inches deep, to exclude the frost. After remaining in this heap one year—till September, or the following February, these seeds are sown out.

Sow seeds of trees during the last half of February, March, or April, on beds of high manured, easy soil, in very fine tilth, and clear of weeds, such as follows hoed green crop, in distance and depth in proportion to the size of the seed, or rather of the annual stem or braird. To deposit the seed at an equable depth, the upper friable mould is pushed (cuffed) off the bed to the interstices between by the reversed head of a rake, as deep as necessary; the seed is then deposited by the hand, and rolled over by a very light roller to fix it, that it may not suffer derangement by the return of the earth which is then evenly *cuffed* back from the sides, and no harrowing or raking given.

Watch most narrowly, and ward off or destroy all kinds of vermin, mice, snails, birds, till the time when the rising braird has disencumbered itself of the husk of the seed thrown up by the ascending stem, and nip out every weed as soon as discernible by the naked eye. In order to diminish the toil of watching, the different kinds should be sown as near the same time as their nature renders prudent, and the seed-beds be situated as near each other as circumstances will admit.

At the end of the first or second season, according to size and closeness of plants, remove the seedlings from the bed to nursery rows, at any time when the leaf is off, and the ground sufficiently dry not to poach; before April for deciduous trees, and during April for evergreens, placing them in rather open order, either by dibbling or laying, according to the nature of the root, firming the plants well in the ground; in case of dibbling, taking good heed to leave no vacuum of hole under the root, and to work the tool so as to compress the earth more below than above.

Keep the soil loose and friable on the surface, and clear of weeds between the transplanted rows by repeated seasonable hoeings, and let the plants rise with a single leader.

After the plants have stood one or two years in the nursery-row, remove them to their ultimate destination with as little fracture or exposure of root as possible,—the larger rooted by pitting, and the smaller by slitting, or as the nature of the soil may require; paying most particular attention to plant the dry ground early after the leaf has dropped, and the moister and more adhesive soils in succession, as they become so dry in spring as not to adhere to the tools in working, or poach in treading the plant firm in; removing the evergreens earlier, or later, in April, according to the dryness or moistness of the ground; dipping the roots in a clay-puddle, and endeavouring to seize the opportunity of planting before a shower, should the spring be far advanced and dry, especially in the more arid situations.

Stout healthy seedlings, one or two years old, may be at once removed from the seed-bed to their place in the forest, and will often succeed as well as when nursed in rows, as above.———We have preferred the pick of the seedlings to the common run of the transplanted, as being probably stronger growing varieties.

In cases where it is practicable, work over the new plantations for several years with crops of potatoes, turnips, lettuce, &c., manuring the ground, if possible; and then sow out with perennial rye-grass and white clover, if the trees are not become a close cover, making economical use of the grass as early in the season as it can be mowed with a short scythe.

For seeds that require to lie a season in the rot-heap, such as ash keys, haws, &c. September-sowing is preferable to deferring it to the following spring, as they are liable to chip in the heap. If not sown in September, they must be got in as soon in February as possible.

Acorns, Spanish and Horse Chestnuts, are best sown when they drop from the tree; but when the seed is not procured till spring, the sowing ought not to be deferred beyond February and March. The best soil is a deep rich loam.

Elm-seed may be sown in June, when it is new from the tree; or carefully dried and kept over season till next spring; one-half may then be sown in March, and the other in April, as the March-sown is sometimes injured by late frosts. The utmost care is required to prevent this seed from heating when newly gathered.

Beech braird is also liable to be cut off by spring frost; the seed should therefore be sown partly in March and partly in April, to diminish the chance of entire failure. The soil requires to be rich, and is benefited by a dressing of well-made manure previous to sowing.

Sycamore Plane braird also suffers by late frost, and for greater security ought also to be sown partly in March and partly in April. Planes require dry, poor, rather exposed sandy soil, for seed-bed; as, in rich damp soil, the top of the annual shoot does not ripen: the seed ought to be thinly sown.

Birch and Alder seeds require to be sown in March, or beginning of April, on very fine, rich, easy mould, giving them very slight cover, especially the birch.

The Coniferæ, Scots Fir, Spruce, Silver Fir, &c. should be sown in April, on very rich easy soil. The greatest care is required to deposit these different seeds at proper regular depth, from an inch to the fourth of an inch, in proportion to the size of the seed.

Larch should also be sown in April; it succeeds best on the clean mellow ground which has produced a crop of seedling Scots fir. It is worthy of remark, that the larch seedlings and row-plants are liable to die under a putrescent disease, when much recent manure is employed.—We remark this accordance with its tendency to putrid disease in after life.

Acorns, Chestnuts, and other large seeds, may be economically sown in drill: where the soil contains much annual weed seed, this admits of expeditious cleaning by the hoe. Ground which has borne a crop of potatoes the preceding season, is unfit for seed-beds, as the tubers and seed of the potato give much trouble.

These are the chief of Mr Sang's directions on raising timber-plants. With the exception of kiln-drying of cones, and being rather too prodigal of manure to the seed-beds (perhaps necessary in a sale nursery), we see nothing in the volume to censure.—A premium should be offered for a convenient plan of distributing fir-seed suitably in the seed-bed, without the aid of artificial drying.

It is perhaps unnecessary to state, that, in the culture of trees, there are thousands of incidental circumstances to which general directions will not apply, and which demand a discriminating judgment in the operator: this acts as a school to the mental acumen; and there is no class of operative men, which has the faculties of attention, activity, discrimination, and judgment, more developed, than nurserymen and gardeners,—whose diversified labours, requiring, at the same time, constant mental and corporeal exertion, keep up a proper balance of the human powers.

We leave to the judgment of the operator to proportion the thickness of sowing of the different kinds of seed to the expected size of stem and leaf, under regulation of soil, season, and quality of seed; and to determine whether the plants may be continued more than one season in the seed-bed, or be entirely or partly drawn the first, which must depend on their luxuriance and closeness; also to notice if all the seeds have vegetated the first season, or if many of them still be inert; in the latter case, the seedlings must be picked out; to facilitate which, the earth may be gently raised by a three-pronged fork, with as little superficial disturbance as possible.

In nurseries, the great and general error is having the plants too close together, particularly in the row. Every nursery-row plant should be of a regular cone figure, with numerous side-branches down near to the root, and gradually widening in the cone downwards. These would, indeed, occupy more space of package, and probably not please the ignorant purchaser, who generally prefers a clean, tall body; but they would support the hardships of removal to the moor, and be stately trees; when the comely, straight, slender plants would either have died altogether, or have become miserable, unsightly skeletons, or stunted bushes.

In cases where plants are required of considerable size, for hedge-rows or park-standards, it is matter of doubt, how far frequent removals in nursery, or cutting of roots, is profitable. This occasions fibrous matted roots, which tend much to the success of the ultimate removal, and to the growth of the plant for several years after; but, by checking the disposition the roots naturally have to extend by several wide-diverging leaders, probably unfit the plant for becoming a large tree.

Mr Sang remarks that sycamore planes and birch should not be pruned in the latter part of the winter, as they bleed greatly at that season: we have often noticed this as early as midwinter, which also occurs to the maple tribe. Our author introduces the mountain-ash as a forest tree, a rank it by no means merits, at least for value as a timber tree. When exceeding six inches in diameter, it is generally rotted in the heart, and is only valuable as a copse for affording pliant, tough rods; or twigs, as a charm or fetiche against witchcraft! It is, however, one of our most beautiful trees.

Mr Sang gives directions for kiln-drying fir cones previous to thrashing out, or extracting the seeds. We have before adverted to this, and would particularly reprehend the practice. It is difficult to determine how far early fruitfulness and consequent infirmity of constitution, diminutiveness of size at maturity, and early decay, may originate from kiln-drying the cones; but, from the same process of drying in a less degree having been ascertained to induce early seed-bearing in the case of other seeds, we may infer almost to certainty, that the coniferæ of this country, not naturally planted, are very materially injured by this practice.

It is of small consequence, in reference to the tree itself, at what season deciduous trees are planted, provided they be naked of leaf, and the ground not too dry, as they are not liable to lose much by desiccation or evaporation by the bark alone, before the roots strike anew in spring, and draw freely from the soil; and the skin of the bulb, although the small rootlets be broken, sucks up moisture from the damp soil to repair the loss by superior evaporation: but evergreens—firs, hollies, laurels, yews, sometimes suffer by removal at a time when the roots do not immediately strike, as in winter, owing to the torpor from cold. We have often seen their juices exhausted, and their leaves entirely withered, by a continuation of dry northerly winds, the manifest cause of which was the great superficial exposure of the leaves evaporating faster than the fractured torpid roots afforded supply. Therefore, although winter planting seldom fails, yet it is perhaps better to seize the exact time in spring, immediately before the roots commence to strike anew, before there is any new top-growth, and while the soil and air remain somewhat moist and cold, that the evaporation may not be too great. In this climate, April is a good season for removing evergreens to the field, although, to throw the work from the busy season, it is often practised in the nursery in September, when their annual growths are completed, and while there is yet warmth to enable the roots to strike anew; this, however, is only advisable where the soil for their reception is in the most favourable state, friable, and inclining to moist, or when there is great indication of rain, and the air near the dew point. Of course they require to be planted as soon as extracted. In winter or spring, when it happens that evergreens must lie in the *shough*, the most protected situation, where the air is moist and still, ought to be chosen, and the earth carefully closed to their roots, which is best done by watering, if rain be not expected; the stems and branches should also lie as close to the ground as possible.

There is appended to this valuable Planter's Calendar a treatise on the Formation and Management of Osier Plantations. As this will not bear compression well, we refer our reader to the volume itself.

III. Billington on Planting.

We have perused Billington's account of the management of the Royal Forests with much profit; it affords us an excellent series of experiments, shewing how much conduct and integrity may exist in Government establishments, even although the strictest watch be *not* kept over their motions by the nation itself. Words are awanting to express our admiration of every thing connected with the management of our misnamed Royal Wastes. We scarcely could have hoped to find such pervading judgment and skill of calling, as have been displayed by the Commissioners, and Surveyors General and Particular; but it is true, the noble salaries attached to these situations must induce men of the very first ability and knowledge of the subject, to accept of the office.

Our author, Mr Billington, proceeds with great naiveté to relate how they sowed and resowed acorns —how they planted and replanted trees, persevering even to the fifth time, sometimes covering the roots, and sometimes not, " but all would not avail," nothing would do; the seeds did not vegetate, and the [illegible] Yet this is well: we rejoice over the [illegible] of the native and legitimate inhabitants of the Royal Domain, the [illegible] sheltering the invaders the [illegible], who, year after year, to the amount of many millions, made hostile excursions into the forest. We only deplore the cruel doom of the mice, on whose heads a price was laid, and of the converts, who, acting as allies of the native powers, merited a better fate than indiscriminate slaughter.

May we hope that our Government will no longer persist in unprofitable endeavours to turn cultivator, or to raise its own supply? We laugh at the Pasha of Egypt becoming cotton-planter and merchant himself, in a country where the exertions of a man enlightened beyond his subjects, who has influence to introduce intelligent cultivators, possessing the knowledge of more favoured nations, may be necessary to teach and stimulate the ignorant Copt to raise a new production: And here, where discovery in every branch of knowledge almost exceeds the progressive,—here, where so many public and government *fixtures* stand out, as if left on purpose to indicate the recent march of mind, contrasting so strongly with private and individual attainment in science and art,—with every thing the reverse of what affects the Egyptian's conduct; or, at least, with no excuse beyond affording a cover for a wasteful expenditure of the public money;—will our Government continue the system, heedless of reason or ridicule? or will they not at once end these practices, and immediately commence sales of every acre of ground to which the Crown has claim, excepting what is necessary for the use of royalty, abolishing Woods and Forest Generals, Rangers—every one who has taken rank under Jacques' Greek, or the devil's own invocation, and pay off a part of the debt which is crushing the energies of the first of nations?

Yet it is not of individuals that we complain; perhaps nobody could have had a stronger *desire* to do his duty, than the late Surveyor-General. It is the system that is naught; where, to the lowest labourer, none have individual interest in the success of their work; and where the efforts of the really honest, intelligent, and industrious are, by directions and trammels, rendered unavailing; or even through misrepresentation by *those* of a contrary character, (as would seem in the case of Mr Billington), are the cause of dismissal. . . . .

We can only predicate of the future from the past. In spite of all our Parliamentary acts respecting these forests, and the clamour that for ages has been made about them, they, with little exception, have existed only as cover for sinecure expenditure, or for display of tyro ignorance and incapacity, and subject for pillage, thieving, and frauds of every description*; (*vide* Parliamentary Reports). We could easily—by a very simple incantation, requiring a rod neither tipped with silver nor with gold, but merely a plain cane or sword—bring forth a sufficient quantity of large growing oaks to meet any emergency. Our charm would be to give the title of Prince to the Duke who should possess, and have at the command of Government at a fair price, a certain number of oaks above a certain size, and a step of elevation to every titled person, and the title of Baronet to every private gentleman, who should possess a given number, diminishing the number requisite to give a step as the title became lower. We should conceive this law would not render nobility of less estimation. Perhaps the clause might be added, that one tree raised on waste ground should count two.

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* They say a better management has lately been established. This may be followed for a short time in the high stream of the agitation, or while the present heads of management remain in power; but the system, we fear, contains the seeds of evil, which, like the weeds, will soon overwhelm the alien good.

As a treatise on the rearing, or rather prevention of the rearing, of young planting, Mr Billington's small volume possesses some real merit; and simplicity and useful and sagacious remark are so blended together, as to afford to the reader at once amusement and information. We are something at a loss to account for this incongruity. Has the seclusion of a forest life given a cast of the *naturel* to his mental product; or has Jaques of Arden really been in Dean with his celebrated invocation?

Mr Billington's directions on pruning and training are generally good; but he distances common sense when on his hobby of shortening of side branches, in recommending to extend this practice to pines. His breeding as a gardener, and consequent taste for espalier and wall-training, where every shoot must be under especial direction, seem to have unfitted his mind to expand to the comprehension of nature's own process of action, and disqualified him from walking hand in hand with her. We also consider that no good, but rather evil, would result from continued cutting in, and lopping off the points of the branches of all kinds of trees, excepting when the plants were stunted, or much covered with flower-buds. Even a very slight clipping greatly retards the growth of hedges; and the labour and attention requisite would be very great: besides, the poor things, the trees, trimmed to the Billingtonian standard, would, amongst the unrestrained beauties of the forest, be ready to sink into the earth for very shame of their *formal deformity.* He errs, too, in recommending not to plant sycamore plane, as being of little value while young. We have sold young planes, six or seven inches in diameter, at a higher price per foot than large oak. They will generally find a good market wherever machinery abounds, and will probably become every year in greater request.

Mr Billington is particularly solicitous to render his instructions as plain as possible, in describing the mode of pruning young oaks in formation of knee timber, as he confesses to bring it down to the comprehension of gentlemen; but he is not very happy in his figures of oak trees trained to this use, from want of acquaintance with the cutting out of naval crooks. He remarks that "larches are more liable to die in wet ground by their roots being soaked in water during winter, than oak and some other kinds;" but ground that is at all pervious to water, ought not to be planted till it be drained in such a manner that water will soon disappear from shallow holes; and where, from the plastic closeness of the clay, draining is not quite effectual, the planting should take place as late in the spring as the breaking of the buds will permit; and principally by slitting, which, by not breaking the natural coherence or turfiness of the soil, affords less opening for water to stagnate around the roots, and does not occasion the soil to sink down into the mortary consistence consequent to pitting; there is also less destruction of the vegetables growing in the soil, hence less putrescent matter to taint the water that may stagnate round the roots; pure water, or water in motion, not being detrimental to the roots for a considerable time: also, when the plants are put in late in spring, there is seldom long stagnation of water that season, and by next winter the ground has become so firmed around the roots as to allow very little space for water, and has also acquired a certain granular arrangement akin to polarization or crystallization, which allows the water gradually to percolate; it is also bored by the earth-worm, and other insects, and the plant itself, after the roots have struck anew and the fractures healed, possesses a vitality which better enables it to withstand the exclusion of air from the roots, and chilling by the water the ensuing winter, and either prevents absorption of the stagnant fluid, or counteracts its putrid tendency. Planting succeeds best in soil of this description when the ground has been under grass for some period, at least the new planted tree, in this case, is less liable to the root-rot; and trenching or digging previous to planting is of more utility, as the turfiness prevents the clay from sinking down into impervious mortar, and allows the water to percolate to the drains.

Mr Billington is very earnest in recommending to drain well at first, and to keep the drains (open drains) in repair; he also directs, where the ground is very impervious and wet, to take large square sods, about 18 inches square and 9 inches thick, from the drains while digging in early winter, and place one of these, the grassy side undermost, in the site which each plant is to occupy. In the spring, by the time of planting, the sod has become firmly fixed, and the two swards rotting afford an excellent nourishment to the plant, which is inserted in the centre of the sod, with the roots as deep as the original surface; the drains, being necessarily numerous, afford turf sufficient for all the plants. This is good. He also gives sensible directions to beat down, hoe, or cut away all weeds, shrubs, and grass, from the young plants, and to remove all rough herbage and thickets of shrubs, that form harbour for the short-tailed mouse, which is exceedingly destructive, in the case both of planting and sowing; in the former, by nibbling the bark from the stem, and biting off the twigs of the young trees, (from which our author may have taken the hint of cutting in, as mankind took that of pruning from the browsing of the ass), and gnawing their roots immediately below the surface of the ground; and in the latter, by devouring the seed in the ground, and cutting down the seedling annual shoot. He also instructs to keep the tree to one leader, shortening all straggling large branches; but his assertion, that plants which had the tops of the straggling branches pinched off in the first part of summer, grew much larger in consequence, looks rather absurd; although we have known a part of a hedge, clipped a week or two after the growth had commenced in spring, grow more luxuriantly than the part which had been pruned in the same manner before the growth had commenced. This was owing to the check by the late clipping, throwing the period of growth into warm moist July; what was earlier clipped performed its growth in dry June, and was considerably injured by the manna blight which the latter escaped *. The same cause operates to induce late sown grain and wheat, which has been thrown late by much injury of spring frost, to acquire a larger, more luxuriant bulk, than that of earlier growth.

It would appear to us that Mr Billington, from ignorance of the value of larch, and of the soil proper for maturing it, has done more injury to the parts of the royal forests where a growth of timber was obtained, by cutting out the thriving larch, than will be compensated by his pruning and training of the sickly stunted oak which remained, as described by him, scarcely visible, when the larches were of size for country use; but we forget; no blame can attach to him—his orders were, that every thing should give place to oak.

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* The inferior growth of the part of a hedge which was pruned before the vegetation had begun, may be ascribed to the vital action having been checked at the commencement by the destruction of the buds necessary to stimulate this action; and being deprived of this first strong impulse, life had remained languid throughout the season, the roots never recovering their proper suction or foraging power;—when the pruning was later, a sufficient stimulus had already been given.

In parting with our author, it is but just to state, that we consider many may profit by a perusal of his pages: that notwithstanding the simplicity to which we have alluded, there is often something sterling in his remarks and reflections, the result of much experience, resembling the original freshness of our writers before writing became so much of a trade. In some places, indeed, his narrative is so simply, naturally descriptive, and speaks so eloquently, of ignorance of climate, season, soil, circumstance —of all the unknown dangers and difficulties incident to *their* new employment—and of the wonderful contrivances and inventions hit upon to remedy them—that, when perusing it, we could scarcely persuade ourselves we were not engaged with Robinson Crusoe.

X.—Forsyth on Fruit and Forest Trees.

The *surgery of trees*, which this author has the great merit of almost perfecting, is the only important matter in this volume. His composition salve, on the merits of which he expatiates so much, and for the discovery of which he received a premium from the collective wisdom of the nation assembled in Parliament, is, however, a piece of mere quackery; and all the virtue of his practice lies in the cutting out of the dead and diseased parts of the tree, thus effecting for vegetables by excision, what nature herself performs for animals by suppuration, exfoliation, and absorption.

Mr Forsyth's surgery is of slight importance to timber trees in respect of economy, as with them as with man, it is generally easier to raise up anew than cure the diseased. Yet it is well that the rationale of this practice be understood by foresters, more in regard to prevention than cure; an occasion will however sometimes occur where a tree may economically be benefited by surgical aid: and in cases where the

Dryades acquire lasting attachment to particular objects, the science is invaluable, as the object of their love may be thus continued flourishing to the end of time, or as long as the inamorata chooses to pay the surgeon.

Mr Forsyth presents us with numerous models of knives, irons, and gouges, suited to the operation of removing the dead parts of his patients. Where the gangrene occurs in the outside, he hews and scrapes away with these till every portion in which the vital principle is extinct be detached, and the surface all regular and smooth, so scooped out as to afford no hollow where water may rest. He then gives a coating of his composition salve to all the space operated on, wherever the cuticle of the bark has been broken, which prevents the drought, rain or air, from injuring the bared parts till the bark spread over it. In cases where the removal of all the dead part at once would endanger the stability of the tree, he first removes it along the borders of the decayed part all round, close to the sound bark, of such a breadth as to give full room for the bark to spread over in one season, and covers this with his pigment, annually repeating the cutting out, and painting around the rim or edge of the new-formed bark, till the whole of the dead part be cleared away, Under this treatment, the excavation is gradually filled up with the new wood forming under the spreading bark, and the wound becomes cleanly cicatrized. Mr Forsyth has effected complete renovation, where the sound vital part consisted only of a narrow stripe of bark and alburnum upon one side of the stem, and where two cart loads of the diseased trunk had been scooped out.

When the heart of the tree is decayed, he makes a section longitudinally in the side of the tree, as far up and down as the rot extends, and of sufficient width to admit the working out the diseased part; and managed as above, the bark and wood gradually extend from the two sides of the section into the vacuity, and fill it up entirely with new sound timber. When the tree is of considerable diameter, the opening formed in the side of the stem must be wide, nearly extending to half the circumference, otherwise the sides of the section would meet before the bark extended over all the inside. When the bark from the two sides approaches to touch in the bottom of the hollow, he pares off the cuticle from each side where they join, in order that they may unite thoroughly. Should any of the roots be diseased, he removes the earth, and pares away the corrupting parts; and if the top be stunted or sickly, he crops it at the joints where the smaller branches separate, whence numerous fine strong shoots spring forth, whose new vigour of vegetation, and absence of drain by seeding for several years, generally renovate the whole plant, and occasion the filling up of the wounds (should the trunk be under cure) to proceed rapidly.

Need we mention, that it is only in the cases where the partial death or decay has resulted from casualty, or something not connected with the general system of the plant, or with the soil, or other external circumstances (unless these can be changed), that renovation by clearing away the decayed or sickly parts is attainable? Where the plant is sinking from mere old age, a source of decay of which in some kinds at least we have doubts, or from the soil being improper or exhausted for the particular kind of plant by long occupancy, or from any circumstance not admitting of remedy, the attempt to heal up the wounds caused by cutting out the diseased parts, or to induce new vigour by cropping the top, must be abortive, or only attended with partial or temporary success.

Our author, who is a practical man, apparently very little disposed to throw away time upon inquiring into causes, does not attempt even to guess at the mode by which his composition performs the wonders for which he gives it credit. It is impossible, by any salve, to promote discharge from the bare alburnum, though cut into the vital part, to form, or assist in the formation, of bark; and the sum of the resulting advantages consists in preventing the vitality from becoming extinct far inward from the section (as under the best management to a certain extent it will become so), by an antiseptic cover from the drought and moisture, heat and cold; in promoting the spread of the juices from the edge of the bark over the bared part by exclusion of drought, and by forming a defence against insects. We have found a paste of pure clay, wrought up with some fibrous matter, as chaff or short hay, an excellent cover for tree wounds, applied in spring or early summer, when dry weather followed the application; but in autumn or winter, and when moist weather followed, the clay, by remaining wet, only served to induce corruption. We think this clay paste (probably benefited by a powdering of charcoal on the inside) the best application when applied in spring. We have seen a terminal cross section, of about one inch diameter, of a long branch, covered quite over in two months with bark when clayed; and a tree of three inches in diameter, from which a dog had torn off the bark from one half of the circumference of the stem, entirely renew the lost bark in one season, when immediately clayed over. Resins, oils, bitumen, paints and composts without number, have been used with more or less success, depending upon the period of the year, weather, kind of tree, individual health, and other circumstances; but these salves should, as in flesh-wound salves, be considered only as protections, or slightly auxiliary to the restorative energy of nature, not as cures.

V.—Mr Withers.

Having by chance glanced over a pamphlet by an Englishman, a Mr Withers, we find there has been jousting between that gentleman and our Scottish knights, backed by their squire the Edinburgh Reviewer, in which the discomfiture of the knights has been wrought by simple hands.

It seems Sir Henry Steuart, forgetful that his own bright fame, which rivals that of the discoverers of steam-power and gas*, though of comparatively quick growth, will endure for ages: and led astray, probably, by the foolish adage, " soon ripe, soon rotten," had stated unqualifiedly, that " fast grown timber will sooner decay, and is of opener weaker texture than slow grown of the same kind ;" and on these false premises concluded, that all culture or application of manure to further the growth of timber is improper—winding up with some patriotic flourish about danger to our war navy, from Mr Withers rendering the British oak of such exceedingly rapid growth as to be soft and perishable as mushrooms. Withers completely demolishes his literary and scientific adversaries, but is, withal, so very imperfectly acquainted with the subject—himself, and also his junto of experienced correspondents, that we shall attempt a few lines in elucidation.

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* Vide Sir Walter Scott.

We shall first state our facts, accompanied with explanatory remarks.

No. 1. An ash tree of about 18 inches diameter, and 65 years of age. The first 35 years, the annual growths were of middle size, and the timber weighty and tough; the following 15 years, very small, light, porous, and free; the latter 15 of middle size, and of fair quality. This tree had been growing till about 49 years of age in a grassy avenue, of dry clay soil, and close by a deep ditch. About sixteen years back, the ditch had been filled up, and the ground ploughed and manured regularly till the tree was cut down. After 35 years' growth, the scorching roots of the ash had rendered the soil so dry, that the tree had run entirely to reproduction: *Nearly all the nourishment from the ground assimilated in the leaves being expended in forming seed, no extension of the top had taken place, and* *thence no thickening of the bole being necessary for support, no wood proper had been deposited on the trunk save the annual rings of lineal tubes to convey the sap, which constituted a brittle light wood, of very slight lateral adhesion* *. After the ditch was filled up, and the surrounding ground ploughed and manured, the increased supply of moisture and nourishment had induced a considerable new extension of top (which was quite visible in fine young healthy branches rising from a stunted base), and consequent necessary thickening of stem by annual layers of proper dense wood, along with the lineal annual tubes.

No. 2. A beautiful most luxuriant growing oak, in one of the sweetest sunny spots of the sweetest valley of our Highlands. This tree, of nearly two hundred solid feet of timber, and 80 years of age, was growing upon the bare shelf of a sound mica-schist rock. From underneath this shelf, several feet down in front, a most exuberant spring welled out, and the roots spread down over the rock to the mouth of the crystal spring, no doubt tracing inward the course of the limpid waters into the rocky chambers of the Naiad. We had much conjecture how this tree came to be growing on the bare shelf, and finally concluded, that the nymph of the spring, while she sat there gazing on her beauties, under the varying dimpling reflection of the living waters, her rosy feet bathed by the glassy flood, had been surprised by some rude Celt, and to effect escape from his rough embrace, had been transformed by Diana into a tree. Yet whether of natural or supernatural origin, it was by the people of the glen held of miraculous virtue, and the sickly children were brought to be dipped in the spring after being borne several times round the charm-tree. When torn from its seat, the tree, though sound, and having a level fall (we saw it fall), broke across about twenty feet up, where the stem was about eight feet in circuit; *this was owing to the very soft tender nature of the wood, which, although consisting of very large annual growths, was, when sawn out, the most porous insufficient Scots oak we have ever seen.* As this fact may be ascribed to the supernatural,—the heart of the nymph beginning to soften towards the Celt at the time Diana interfered, accounting well for the soft texture of the heart-wood of the tree, we shall not press it as a proof on either side of the controversy. Perhaps sober reasoners may think this all phantasy, and conclude, that the tree, from deficiency of substantial earthy food, and subsisting principally on *slops* (being mainly nourished by drinking of the delicious well), would, like an animal under similar circumstances, be of soft flabby consistency.

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* The want of the annual layers of cellular tissue of wood, exterior to and separating the annual lineal tubes, is so complete in some cases of slow growth, that the timber seems only a light congeries of tubes, without arrangement; hence the age of the tree cannot be determined but by a section of the root-bulb, where the growths are larger, and the deposits regular.

The above fact is opposed to common opinion—a Highlander always choosing his oaken staff from off a rock, as being most to depend upon; yet perhaps this preference is owing to some association with the hardness of the rock itself.

No. 3. We found a sycamore plane (Acer pseudoplatanus) in the same row with other sycamores, and about the same size, so exceeding hard that it could scarcely be cut down by mattock and hatchet, whereas the others adjacent were comparatively of moderate hardness, though differing considerably in hardness from each other; the soil in this case was very equable, being of Carse clay. The peculiar hardness of this tree could only be attributable to a harder variety. Indeed, the difference of quality in timber depends chiefly on the infinite varieties existing in what is called Species, though soil and climate have no doubt considerable influence, both in forming the variety, and in modifying it while growing. Of varieties, those which have the thinnest bark, under equal exposure, have the hardest wood.

No. 4. We have cut a number of large old ash trees, and found, with one or two exceptions, of what is called thunder-struck trees (which we consider only an obdurate variety), that they were invariably of very free, weak consistency, more especially the latter formed growths, but even the earlier growths had become *frush* from age. This timber soon went to decay after being cut down :—one piece cut out into planks, and these being laid down in the order they occupied in the log, was in the course of some weeks rendered again entire by being agglutinated by Jew's ears (a species of fungus.) The workmen were greatly startled at the fact, thinking the log bewitched. When immediately dissevered by wedges, the wood was so much decomposed, that its fibre was tenderer than the Jew's ears, separating in a new course in most places, in preference to the saw draught occupied by the ears. We have found very old oaks have exactly the same friable character, so much so, as render their safe felling almost impossible ; yet this oak timber had not lost much in weight when compared, after being dried, with younger oak.

No. 5. We cut a row of ash trees, about 50 years of age, in dry Carse clay, by the side of a deep ditch, and consequently of slow growth; the timber was excellent, hard, strong, and weighty, rather most so where the size was smallest. At one end, where the row approached a brook, and the soil became richer and moister, several of the trees were of good size, but rather inferior in quality of timber, excepting one (the largest, though not the nearest to the brook), which was of very hard, strong, and reedy fibre, evidently a variety differing much from the others. It is always easy to discriminate pretty accurately the quality of the wood, by examination of the saw cross section of the trunk, that is, provided the same saw be employed, and be kept equally sharp; the best timber having the glossiest, smoothest section.

No. 6. We have examined Scots fir grown in many different situations; by far the best quality, of its age, of any we know, stands upon a very adhesive Carse clay, which, from the proprietor's neglect, is all winter and in wet weather soaking with water, and the trees not of very luxuriant growth. These, till a few years ago, stood in close order, without the stem being much exposed to parching or evaporation; this exposure of the stem rendering fir timber much harder and more resinous. Every body who has touched larch must be convinced that the slow grown on poor *tills*, especially with long naked stems in exposed situation, is very much stronger and harder than the quick grown, though often not so tough: but much depends on the variety in larch, those having the reddest matured wood being much harder than the paler coloured.

Memel fir, which is the largest growthed red pine we are acquainted with, is generally esteemed very strong and durable, probably next to the pitch pine of North America; yet the very large growthed Memel is generally weakest, though we frequently find a log of small growthed, mild and inferior in strength. In old buildings we have often witnessed the beautiful small growthed red wood pine wormed, when the larger growthed was sound, but we are sensible that spontaneous decomposition and consumption by insects are very different; much resin deters insects, whereas, in moist situations, as in treenails of vessels, it conduces to spontaneous decay; yet is it preservative when the timber is exposed to the weather by excluding the rain.

The coniferæ differ much in the internal arrangement of their woody structure from the hard wood species, having tissue of much larger cells, and being generally destitute of the large lineal tubes, which in hard wood constitute the more porous inner part of the annual layer. When these tubes occur in the pines, they also differ in position, being in the outer part of the layer. Owing to the resin of the pines becoming fixed in the cells of the outer part of the annual layers, inspissated, we think, by the summer's heat and drought (others say congealed by the cold), these cells are filled up, and this part of the growth rendered much denser than the inner part of the layer, being from solidity semi-transparent. We would attribute the abundance of resin in the Georgian pitch pine to the heat and long summer of that country, probably in concert with damp richness of soil, not only occasioning this deposit under these circumstances, but perhaps inducing a disposition in this species to the formation of this product *. The absence of the lineal tubes,

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* The climate of a country in regard to annual steadiness, can be pretty accurately determined by the appearance of the annual layers of trees, especially of the pine tribe; and in a new settlement where great difference of size of layer, and of resinous deposit is observed, we may be pretty certain the seasons are not

and the presence of oleaginous resin, render pine timber, when old and small growthed, not so brittle, nor so liable to decay, as that of deciduous trees; but it becomes very deficient in lateral adhesion. From the same cause we find the external layers of matured pine timber comparatively superior to the quality of the inner layers: in hard wood the exterior layers are generally much inferior to the inner. Boards of sap-wood of fast grown Scots fir, particularly of the outside layers are much better suited—stronger and more lasting, for boxes used as carriage packages, or for machinery or cart lining much exposed to blows and friction; than boards of the best matured red wood of Memel, Swedish, or Norway pine. This is principally owing to the fast grown alburnum possessing much greater lateral adhesion than the matured wood of old pines. To have these sap-wood boards in greatest perfection, the tree must

steady, or that insect depredations or blights occur; and a reserve of food ought always to be retained. By careful inspection of the nature of the annual wood deposit, or of the locality with regard to moisture, it may be ascertained, whether the irregularity has been owing to difference of temperature, or of moisture. In warm climates the irregularity will generally depend on drought and moisture, and in cold climates on heat and cold; though sometimes the depredations of insects, such as locusts, or of blights, may be the cause.

not lie in the bark after felling, and the boards must be well dried soon after being cut out. To expose the tree, peeled, either standing or felled, to the sun and dry air for some time, will considerably increase the strength of this alburnum. The wood, while in the state of sap-wood, of many kinds of timber is as strong and much tougher than the same wood after being matured, and would be equally valuable were any process discovered of rendering it equally durable; its insufficiency often arises from partial decay having occurred while in the log. The same sap-wood of oak, which, allowed to lie on the grass after being peeled in spring, will be so much decomposed in autumn that it may be kicked off with one's heel; if cut out and dried immediately on being felled, it will be tougher than the matured, and, kept dry as cart-spokes, and defended by paint from the worm, will last and retain its toughness for an age. The filling up, which to a certain extent occurs in maturing, is most probably deposited to fill up tubes, and may thus not greatly strengthen the mass; a hollow cylinder being stronger than a solid cylinder when extending horizontally over a considerable stretch, like a joist or beam; the mass may also become a little more fragile by maturing: besides a filling up is the result of some chemical change the wood probably becoming slightly carbonized or approaching to that change which takes place when vegetables become peat.

It is rather difficult to speak of the strength of timber, as different kinds of timber, and different parts and qualities of the same kind of timber, have different kinds of strength. Some kinds are stronger as beams or joists, other kinds as boarding; while, again, some kinds are better for enduring a regular pressure, others for supporting a sudden jerk or blow, either as beams or boards. Some kinds are also comparatively stronger, moist; others when dry—and some kinds retain their qualities of strength or toughness longer than others when moist, and others longer when dry, although no rot appear.

No. 7. Purposely for experiment*, we selected three ash trees, all growing in Carse clay, but differing the most in fastness of growth of any we could discover. We cut these down on the same day; two of them proved about 36 years planted, and the third 15; this, the youngest was of fast growth, and had layers of more than double the size of one of the former, and about six times that of the other. We cut a number of pieces of exactly equal length and thickness (17 inches long, and nearly an inch on the side), from each of these, choosing them of clean straight fibre, at equal distance from the ground, and from the outside of the tree, and having their growths nearly parallel to one side, of course free of heart. We proved one of each immediately on being cut out while full of sap, with their growths on edge in horizontal position, supported at each end with a weight suspended from the middle. The smallest growthed, and the largest, weighed at the time of trial nearly equal; the medium growthed one-thirtieth more. The smallest growthed supported the weight about six minutes; the medium and the largest about half that time; the smallest growthed yielded the least before breaking, and the largest yielded the most. When completely dried, the weight of the medium growthed still continued greatest, surpassing the largest one-fourteenth, and the smallest about one-thirtieth. The smallest and medium supported nearly equal weight, during equal time, and outbore the largest about one-seventh*; when placed with the growths on edge, they were stronger than when placed with the growths flat.

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* Though we give this experiment, we admit that little dependence can be placed upon a single fact. The trees must have been different in variety, and probably in sex, both of which may occasion a discrepancy.

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* The time the weight is in suspension, must be attended to. A beam will support a much greater weight during a minute than during an hour; and two beams may be found, the one ca-

After these rather lengthy references to facts, we must allude to a circumstance which we are astonished has not been attended to by Mr Withers, and his gentlemen correspondents connected with His Majesty's docks,—the not taking into account the place of the tree whence the portion of wood for experimenting the strength had been taken, and also how the annual layers stood, whether horizontal or on edge, or around a centre, when the weight was applied. The experienced and accurately practical Mr Withers presents two specimens of oak, the one of faster and the other of slower growth, to Professor Barlow, of Woolwich Royal Academy, and the strength of these specimens is tested and reported upon, without once alluding to what we have mentioned above. Now, if this has not been attended to, the experiment may be considered a test of something else than of the timber. How much the strength is affected by the place of the tree, any person may satisfy himself by proving one piece of timber taken from near the root, another half way up the tree, and a third near the top: he will find that in a tall tree the comparative

pable of supporting the greatest weight during a minute, and the other the greatest during an hour.

strength will sometimes vary as much as 3, 2, 1; that is, a beam, say 2 inches square, and 4 feet long, taken from near the root, when horizontally placed, and resting only at each end, will support three times as much as a like beam in like position from near the top of the tree, although both are equally clear of knots or cross section of grain. This is particularly manifest in large fast-grown silver fir and old ash, and the difference is always greatest in old trees. He will also find that the position of the beam, in respect to the layers being circular round the heart, flat, on edge, or at an angle, has considerable influence, and, should he inquire farther, will perhaps notice, that the timber from different sides of the tree is not always alike strong; that one specimen of timber will be superior to another, both being moist, and inferior to it when both are dry, and that also, as in No. 1, the tree at the same height on the same side, will contain timber differing in strength fully one half, and not always diminishing in strength from the heart outwards, even in hard wood. We are well pleased with one gentleman of the Navy Dock-yard, who naively admits, that he is incompetent to decide on these subjects, having been altogether devoted to the mathematical, in estimating the strain and resistance timber suffers under different combinations. Now we like this division of labour.

But to return to our subject. The facts stated go to prove, that the quality of timber depends much upon soil, circumstance, and more especially on variety; and that in the early period of the growth of trees, before much seeding, and when the soil is not much exhausted of the particular pabulum necessary for the kind of plant, that rather slow grown timber is superior in strength to quick grown, especially when the quickness exceeds a certain degree; when this degree is exceeded, the timber is not so weighty, and is well known not to be so durable. However, when timber is required of considerable scantling, it is only in good soils, where the tree increases moderately fast, that timber will attain sufficient size for this, at an age young enough to retain its toughness throughout, or to continue forming firm dense wood on the exterior. This is particularly so in the case of hard-wood timber, more especially when oak grows upon a moist soil, where the matured wood, of brownish-red colour, is often unsound, and where decay commences at a comparatively early period. In the pine, owing to the oleaginous undrying nature of the sap (resin), the timber retains its strength to a great age; and the reedy closeness of slow growth, for most purposes, outbalances any loss from deficiency of lateral adhesion.

Moderately fast grown timber is much more requisite for naval purposes than for other uses; as, besides the greater longitudinal strength when of large dimension, it has greater adhesion laterally, is far more pliant, and therefore much better suited for the ribs of vessels, where cross cutting a portion of the fibre, from the inattention to training to proper bends, is unavoidable; and whence a disrupting shock (which is rather to be withstood than fair pressure), makes the unyielding splintering old wood fly like ice; the rift commencing its run from the cut fibre. For plank, the lateral adhesion and pliancy of young moderately fast grown timber is equally valuable, especially for those which are applied to the curvature of the bow and stern. Young timber also softens much better by steam, therefore is more convenient for planking, and for being bent for the compass timbers of large vessels. The vessel constructed of it will besides, from the general elasticity of the fibre, be more lively in the water, sail faster, and, though stronger to resist, will have less strain to endure *. Mr Withers's corresponding friends, especially those of his Majesty's Dock-yards, with the good common sense of practical men, are well acquainted with all this, although they get a little out of element when they meddle with nature or causes. Mr Withers is himself equally out of element when he expatiates on the mighty advantage of trenching and manuring at planting, and when he talks of our Scottish holes. The Knight, too, is still more at fault in dreading any great influence on the quickness of the growth of trees from this gentleman's *new inventions*,—and doubly at fault, from conjecturing our navy would suffer from being constructed of the fastest grown British timber there is any chance of our shipwrights obtaining. Since we were in our teens, we have almost every season trenched a portion of ground for planting, and have manured highly at planting †, and for several years afterwards. We have found, when very adhesive subsoil was brought upward, that the trees throve *well* while the ground continued under cultivation; but when the labour ceased, they were soon overtaken by those planted at the same time without trenching. This comparative falling off was evidently owing to the surface being rendered more adhesive by the gluey plastic subsoil being mixed upward with the original small portion of surface-mould. This new surface melted to a pulp by the winter rains, when drought set in in spring, run together, became indurated, and parting into divisions, admitted the drought down to the unstirred ground by numerous deep and wide cracks, which rent the rootlets of the trees, and rendered it impossible for any plant to thrive. There are also many kinds of light subsoil, which it would be folly to bring to the surface, and where little profit would arise from deep stirring, even though the surface were retained uppermost.

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* We shall not here introduce the interminable discussion of dry-rot, as it remains to be proved that moderately fast grown young timber is at all more liable to dry-rot than small-growthed old, provided the sap-wood be entirely removed.

† In fairness, it may be proper to explain, that the greater part of the trees we have thus cultivated have been of *Pyrus*, although we commenced the practice with common forest trees—yet the pear and apple vary nothing from the oak and ash in the primary stage of life, in as far as respects the extension—we can

In cases where the plants were very small, we have found deep trenching of no benefit, but in certain

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also profit fully as much by raising apple timber of proper fast grown variety, as by any other timber; and have it in our power to sell this timber to machine-makers at double the price of oak of the same size.

soils rather hurtful, even during the first years; but with larger plants, such as are often used in England, it invariably occasioned their roots to strike quickly, by affording a regular supply of moisture, and from being easily permeated by the rootlets, expedited the growth, yielding much early luxuriance when followed by skilful culture, but latterly, seldom to such a degree as would lead us to suppose much difference would be discernible at 30 years of age, between the trenched and those planted by mere pitting, slitting, or sowing,—much more depending on proper draining, on young, thriving, small sturdy plants, of best variety,—on suiting the plant to the soil and climate, and on timely thinning.

But even were a very superior ultimate progress of growth obtained by trenching, manuring, and culture of timber, yet as capital and manure will *probably* be more advantageously employed in common agriculture, which gives a comparatively quick return of both, we shall leave to Mr Withers and his coterie of illuminati the whole advantage of his discovery. Economic philosophy is the queen of our Scottish plants; she will not admit any new system of nurture for her subjects without the strictest scrutiny of its utility as applied to her domains, —she proceeds thus to weigh Mr Withers's practice:—

Extra Cost per Acre.

Twenty loads of putrescent manure, at the average price at which thousands of tons are annually imported to the valley of the Tay from *England*, 9s. per load,	L. 9	0	0
Carriage expenses of above, at 3s. per do.	3	0	0
Twenty loads calcareous manure, including carriage (were marl not at hand, lime would cost thrice as much),	4	0	0
Trenching,	9	0	0
Total first extra cost,	L.25	0	0
Accumulation by 28 years' interest, at 5 per cent. nearly,	L.100	0	0

Would land under timber 28 years planted, with growth accelerated by Mr Withers's practice, in two-thirds of the available ground of Scotland, sell at more than L. 100 per English acre? Suppose that the thinnings previous to the 28th year would cover the cost of planting, and subsequent cultivation and attention which is necessary, besides the cost of the trenching and manuring (in many cases they would not), the entire value of the land would be lost. It may be said that the common rules of utility do not apply in this case,—that the landlords will not be moved to any other improvement than planting, and that otherwise their income would be dissipated entirely, without any portion being applied to reproductive uses. We grant all this; but Scottish landlords have very little taste for the Withers' system,—to deface their beautiful wastes, by burying all the fine turf and wildflowers under the red mortar (the common subsoil), or to scatter manure. Planting by pitting and slitting will prove far more attractive; besides, the means are entirely awanting to carry on such expensive proceedings to the necessary extent, and the cultivation of one acre in this fashion would leave 19 untouched, when the whole 20 might have been wooded, in many cases to equal advantage, by the money expended on one. We have known planting executed by contract for one year's interest of the above stated first extra expenditure, which we would match against planting raised by Mr Withers's process, in the same situation. There is also a very considerable proportion of Scotland very suitable for timber where the stony nature of the surface entirely precludes trenching.

Mr Withers, who appears to have no general knowledge of soils and climates, would hold a different language with regard to Scotland and Scotsmen, if he saw the beautiful thriving plantations now rising in that country, planted by mere pitting and slitting, where, owing to the drought in early summer being less fierce than what occurs in the central, eastern, and southern counties of England, and to the herbage being less luxuriant, planting without trenching can always be depended upon. Mr Withers would also have been sensible had he had much practice in rural affairs, that twenty loads of putrid manure per acre at planting, although of very considerable advantage for two or three seasons to the rising trees, in promoting, along with hoeing and digging, an early start to luxuriance, would cause little or no lasting amelioration of the soil. That the vegetable mould naturally occupying the surface is generally by itself a much better defence against the summer's drought, than when incorporated with the subsoil, especially after cultivation ceases; that lasting fertility of ground for timber, though sometimes, is often not increased by admixture of soil and subsoil; and that, generally, the luxuriance of the tree must ultimately depend on the natural depth and quality of the ground itself.

Mr Withers, with that precise knowledge of the subject, and clear conception of the nature of things, which generally accompanies a partial acquaintance with facts, makes a confident and rather imposing appearance as a wielder of language and a logician. From his assumed superiority, we especially wonder that he should possibly have envy of Scotsmen, which, from the tenor of his letter, we are constrained to believe. Need Caledonia remind her noble sister, England, of their consanguinity,—that they are sisters whom nature hath *twinned* together? Is there another in all the earth, with quadruple the advantages of Scotland, who can rank with her in science and literature, arts and arms? And is England not proud of her poorer sister? Or can they feel aught but mutual love?

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Since writing the above, we have looked over some experiments by Messrs Barlow, Beaufoy, Couch, and others, on the strength of timber. These show so much discrepancy of result, as leads us to conclude, that experimenters have not attended sufficiently to the structure and nature of the timber, the position and quality of the different layers, &c. Take, for example, the stem of a tall tree, 100 years old: At the cross section, it is found to consist of a certain number of layers of matured timber, and of sap timber. These layers having been gradually formed, the external, after those more internal have partly dried, and the internal and matured wood being also filled up to more solid consistency than the external, the stem, on being barked, contracts in drying much more externally than internally. As soon as the surface has dried, the outer layers contracting latterly, are not sufficient to surround the undried internal layers, thence split in longitudinal rifts; and as the drying proceeds inwards, the cracks deepen till they reach nearly to the heart—these rifts, when the timber is thoroughly dry, being generally wider in the sap timber than in the matured, more than in the proportion of the size of the respective circles. This effect of drying is what every body is acquainted with.

Besides lateral contraction, there is also a disposition to contract longitudinally by drying, much greater in the external than internal layers. While the tree is undivided, this greater contraction of the exterior layers is prevented, by the adhesion to the drier more filled up central column (which probably had contracted a little during the formation of the exterior sap-wood layers), the contractile force of the exterior balancing equally around this central column. Should this balance be destroyed by the stem being cleft up the middle, the longitudinal contraction will immediately take place, and the two halves will bend outward, from the outside layers contracting more than the inside layers. We have seen an ash tree rend up the middle from the cross section above the bulb, nearly to the top, on being cut across in falling, owing to the longitudinal contractile force of the exterior existing even before drying.

Should the dried stem of a tree, of considerable length, be laid hollow, supported at each end, the outside layer being stretched almost to breaking by the longitudinal contraction being greatest in the outermost part, a very small weight, aided by a slight jerk or concussion, may be sufficient to burst the outside layer on the lower side, the outside layers on the upper side not standing out as a support above, but combining their contractile force with gravity to rend the lower. As the outer layer gives way, the strain is thrown concentrated upon the next outermost, which also gives way, and the beam is broken across in detail. In like manner, when the direct longitudinal strength is tested, the external circles being in greater tension than the internal, the tightest parts of the log will give way in succession, like a rope with strands of different degrees of tightness; yet the lateral adhesion of the layers will have considerable effect in strengthening the mass.

The above explains the fallacy of estimating the longitudinal strength of a thick piece of timber from experiments with small shreds; it likewise explains how a large unbuilt mast is so easily sprung; wherefore a beam round as grown will be rendered stronger as a beam by being formed into a hollow cylinder, by boring out the central part; and also how a square log will be strengthened as a beam, by cleaving it up the middle, and placing the two pieces on edge, with their outside or backs together. In the latter case, the middle, by being turned outside, and exposed to the air, will contract more than what it would do shut up and covered by the exterior wood, especially if resinous pine timber, which continues to contract for many years, owing to the resin, when exposed to the air, gradually drying or undergoing some change, by which it is diminished in size, and rendered similar to amber.

Consideration of the difference of tension of the concentric layers, from the difference of disposition to contract by drying, modified by the difference of position in which these layers may stand, when supporting weights and bearing strain, with the various qualities of timber of the same kind of tree, from variety, age, soil, climate, or from being taken from near the outside or heart, or butt or top, will, we think, account for the contrariety of results which unphilosophical experiments have afforded.

VI.—STEWART'S PLANTER'S GUIDE, AND SIR WALTER SCOTT'S CRITIQUE.

WE have noticed that a sensation has been produced in a certain quarter, particularly among persons of a certain age, by a publication of Sir Henry Steuart of Allanton, on removing large trees, eked out by a very clever article in the London Quarterly, on Landscape Gardening, ascribed to Sir Walter Scott.

It may seem unnecessary to direct the attention of the public again either to this volume or its subject, both of which have already engaged the public attention to a degree greatly beyond their value and importance; but Sir Henry, with all his foppery and parade of decorating parks, approaches, and lawns, and all that sort of chateau millinery, has now and then risen above his subject, and not only given us several hints useful in rural economy, but has also pretensions to have brought out some facts hitherto but imperfectly known, and to have traced them to general principles.

It is curious to remark of how much greater importance the elder part of society—those upon whom wealth has at length devolved, are generally held. Any device, however trifling, which can in any way divert the fancy, pamper the lingering senses, or patch up the body of our second childhood, is infinitely more useful to the discoverer, and meets with higher patronage and more eclat, than what is of a thousand times more consequence to the young. Now, if this were the fruit of filial love, all would be very well—we would idolize the picture: but when we see these discoveries only patronized by the old themselves, in the merest egotism, we blush for our patriarchs, and wonder if time and suffering will be spent as unprofitably upon ourselves.

We wonder much what fascination can exist to a mind of so much ability and culture as that of Sir Henry Steuart, in decorating a few dull unprofitable acres,—causing a few bushes and bush-like trees to change place from one side of a dull green to the other!—laying digested plans of action, embracing a great number of years, to accomplish this very important feat, which most probably the next heir will make *the business of his life* to undo, by turning them back to their old quarters, if he does not, with more wisdom, grub them out altogether as cumberers of the soil! For ourselves, we would rather *baa* with the silly sheep, and nibble the turf, than pass our time in acting over this most pitiful trifling, or in publishing a memorial of our shame. We know not how others are affected, but there is no other place on earth where we have felt such oppression and weariness, as in the extensive smoothed park and lawns around the country seat. We sicken under the uniformity of the heavy-looking round-headed trees,—the dulness of the flat fat pasture, undecorated by a single weed,—the quiet stupid physiognomy of the cattle,—the officiousness of the sleek orderly menial. It may be we are very destitute of taste in this; here every thing is experiencing satiety of sensual enjoyment, is full to repletion; every thing has been sedulously arranged to please, and we ought certainly to admire; but we have no sympathy with such a scene.

The solitariness, the absence of men and of human interest, is not compensated by any of the wild charms of nature. There is small room here for the discovery of the *habitat* and native character of plants, no chance of meeting with a rare species, every thing is modelled to art. The land-bailiff is an adept. With his dirty composts and top-dressings, he smothers the *fog* and the daisy; the scythe sweeps down every idle weed, every wild flower which escapes his large-mouthed oxen. The live smooth bark of the lush fast-growing trees, affords no footing for the various and beautiful tribes of mosses and lichens. The fog-bee has lost its dwelling, the humble-bee its flowers, and they have flown away. Scarce an insect remains, except the swollen earth-worm, the obscene beetle, and the bloated toad, crawling among the rank grass. There is a heavy dankness in the air itself. The nervous fluid stagnates under it,—the muscles relax into lassitude,—inexpressible depression sinks upon the heart.

It is impossible to describe the relief we feel when we emerge again into varied nature beyond the ring-fence,—we have the hill and the furze, the wild-violet and the thyme, and all the sweet diversity of our subalpine flora. We have the thatched, patched hut, the fine ragged children, the blooming cottage-girl,—we have the corn-field, where weeds of every dye, the beautiful centaurea and scabiosa, the elegant fumaria, the gaudy cock-rose, and the splendid chrysanthemum, are contending for existence with the cerealeæ. Look at the broken mound, with its old picturesque trees and tangled bushes; there is the ancient root where the throstle had its nestlings, which are now at large on the leafy boughs, and are tuning their yet unformed notes to melody. Now every twig has raised its new column of foliage to the sun; and branch, and root, and stone, embellished all over in the richest variety of cryptogamic beauty, swarm of insect life. This smooth path has been paved by the lightsome foot; how superior to the gravel-walk on which the labourer has grudged his useless toil! Even the cart-ruts possess an interest, which useful labour has worn. After the smooth monotony of the park; the turf-dykes, the fluting of the ridges, the different kinds of crops, are most agreeable diversity. The dunghil, and chanticleer among his dames, the toiled horse, the lean milch-cow, and the superhumanly-sagacious-looking shepherd-colley,—every thing we behold commands a sympathy, draws forth a wish of benevolence.

As Sir Walter Scott's Critique came under our notice prior to Sir Henry's Guide, we shall proceed in the same order.

In the first half of this article, Sir Walter gives the history, and describes the varied character, of Landscape Gardening, in a very imaginative and felicitous manner, which, as depending on genius and literature alone, was to be expected; but, in the latter part of the essay, when he comes to treat of action and facts, and Sir Henry's *discoveries*, the deficiency in practical knowledge and judgment, only forms a contrast to the fancy, elegance, and erudition of what goes before.

Sir Walter, apparently not quite unconscious of the ridicule attaching to the subject,—to this mighty scientific and historic parade in teaching country gentlemen to amuse themselves by transferring grown trees as they list, from one place to another, without entirely destroying the life of the transported subject,—makes a curious effort to sustain its consequence, by pointing out the immense advantages to a district by the squire's residing in it; insinuating, that every thing which may amuse him at home, and thus induce him to stay, although of itself childish or infamous, becomes of the highest importance, being ennobled by the end. The following courtly quotation is from Sir Walter's proemial observations: "A celebrated politician used to say, he would willingly bring in a bill to make poaching felony, another to encourage the breed of foxes, and a third to revive the decayed amusements of cock-fighting and bull-baiting; that he would make, in short, any sacrifice to the humours and prejudices of the country gentlemen, in their most extravagant form, providing only he could prevail on them to dwell in their own houses, be the patrons of their own tenantry, and the fathers of their own children." Sir Walter does not attempt to describe or analyze the "humours and prejudices" necessary to render the above lures efficacious. Does he infer that such dishonourable power over their fellow men, or that the opportunity of indulging in such low despicable practices, would induce the country gentlemen to sojourn in their father-land? It is impossible to say any thing more insultingly cutting. But we are far from imputing to Sir Walter any intentional offence. Yet we cannot help being angry with the freakish favouritism of Fortune, although we are sensible it belongs instinctively to the female character, often a necessary and very interesting trait; how she dooms one man from his childhood to toil incessantly for a bare subsistence; how she lavishes her favours upon another, and surrounds him from the cradle with every delight; the mind enlightened, the taste cultivated, the body trained to the most graceful exercises, *even whose very amusements* are considered of so great importance as to throw a high interest upon an art of no earthly utility, but, on the contrary, where the labour of many workmen is thrown uselessly away. We are aware that Sir Walter and his Senator only regard these pastimes of the country gentlemen, thus highly, through a reflected interest, the latter in a political view; and the Baronet, from the known warm benevolence of his heart (a feeling generally associated with genius), towards his poor countrymen, to whom he supposes, in the event of the country gentlemen being by any means induced to stay at home, a part of the great land revenue so unjustly wrung from the poor man's labour would again devolve.

It is amusing to observe with what a flow of imagination Sir Walter shews off his friend's inventions —inventions which have been practised with less or more success, in a manner very similar, by almost every planter of note, since the time of Nero. We quote again: "The existence of the wonders,—so we may call them,—which Sir Henry Steuart has effected, being thus supported by the unexceptionable evidence of competent judges *(a deputation by the Highland Society)*, what lover of natural beauty can fail to be interested in his own detailed account of the mode by which he has been able to make wings for time?"—"But although we have found the system to be at once original, effectual, and attended with moderate expense, we are not sanguine enough to hope that it will at once find general introduction. The application of steam and gas to the important functions which they at present perform, was slowly and reluctantly adopted, after they had been opposed for many years by the prejudices of the public,—earlier or later this beautiful and rational system will be brought into general action, when it will do more to advance the picturesque beauty of the country in five years, than the slow methods hitherto adopted will in fifty. It is now found we possess the art of changing the face of nature like the scenes in a theatre, and that we can convert, almost instantaneously, a desert to an Eden."

Now, this is admirable! Even were it granted, that no planter before Sir Henry Steuart's time, or without his instructions, had ever removed a tree of considerable size successfully (though we believe he has nearly as much the merit of discovery in this as in the other curious invention ascribed to him by Sir Walter, "making wings for time," which must certainly have been performed by Sir Henry a long while ago, as we remember time flying very well when we were a truant boy); yet, nevertheless, Sir Walter, now that his paroxysm of admiration has had time to moderate, will surely help us to laugh at the absurdity of his hyperbolic figures of comparison, with steam, and gas, and scenic transformation, which throw such ridicule upon his excellent friend.

We believe that Sir Henry Steuart has been as successful as many others of his countrymen in transplanting grown trees. We have had some little practice ourselves in this art, but which, had it not been for Sir Henry's *discoveries*, we should not have thought of obtruding on the notice of the public. The house we occupied was covered to the south and west by part of an old orchard of apple and pear trees, which excluded the drying south-western breeze, so necessary in a low damp situation. We transplanted nearly an acre of these, certainly with more success and economy than could have been effected by Sir Henry's practice, the soil being so tenacious, that it was impossible to remove the earth from the roots without fracturing all the smaller fibres. The soil, an adhesive brown *Carse* clay, contained a good deal of vegetable matter, to the depth of about 15 inches, when the subsoil, a close hard yellow clay commenced, into which very few of the roots penetrated. This ground had been long under grass, and the upper soil was much bound together by the grass and tree roots. Under these circumstances we adopted the following plan:—

We first had a stout sledge made, about four feet square, of lumber pieces of wood, the side pieces about five feet long, on which it slid, had a small bend, and extended nearly a foot behind the cross bottom sheaths, which were sparred over with three narrow boards. The stout chain of a roller was affixed to this sledge, when at use, to drag it by. In the autumn we prepared the site where we intended placing each tree, by throwing out the earth on two sides about a foot deep, and eight feet square, and then dug over the bottom of this shallow pit one spit deep, and sloped the two other sides, to which the earth had not been thrown, so that horses could walk across it; we then took the opportunity of a slight shower, when the ground was slippery above and hard below, so that the sledge could easily be dragged, and set the labourers to work to dig a narrow trench, two feet deep, and about three feet distant from the stem (more or less according to the size of the tree), around those trees we intended to remove, paying no regard to the roots, but cutting them right down where they interfered with the trench, and where the roots in the central part (the part surrounded by the trench) were not immediately at the surface, paring off the turf till the roots appeared. This being done, we caused them to under-dig and scrape out the clay all round, nearly a foot inward below the roots, and then to introduce two large ladders at one side as levers to upset the tree, the strong end of the ladders being put into the trench, and as far underneath the roots as to catch hold firmly, the outer side of the trench being the fulcrum on which they rested to obtain a purchase, the light end sloping upward about 14 feet high. Two men were then employed upon each ladder; one of them pulled down by a rope attached to the top, while the other guided the ladder, and rocked it a little up and down; and, at the same time, several men hung upon the opposite side of the tree, either by a rope or the branches, till their united force upset the tree with a large cake of clay bound together by the roots, five or six feet square, and perhaps fifteen inches thick, standing up like a wall, similar to what occurs when spruce or Scots fir are upset by high winds, in shallow wet-bottomed soil. We then removed the ladders, sloped the outer side of the trench where they had rested, and pared away the clay from the upset root, till we thought four horses could drag it, one or two men in the mean time sitting in the top to prevent the tree righting. After this we introduced the sledge, pushing it as far back as possible; if necessary, cutting holes to admit the ends of the side-pieces of the sledge through the lower edge of the upset root; and if the tree were large, placing several wet slippery boards under the sides of the sledge, that it might be more easily drawn up the acclivity of the hole. The men hanging or sitting on the top, then let go their hold, and the tree generally righted itself, standing fair upon the sledge as it grew; if it did not do this of itself, they assisted its rising by lifting at the top. The root was then secured firmly upon the sledge with ropes, and the horses were attached, who, by pulling stoutly, dragged the sledge with its load out of the hole up the slope, and away to the prepared new situation, one man walking at each side, having hold of a rope attached to the top of the tree to guide and steady it when passing a furrow or other inequality of the road. The horses were led across the new site, and stopped when the sledge and tree were in the pit, about a foot past the berth; the ropes fixing the stool on the sledge were then untied, and, by pulling backward upon the ropes fixed to the top, the tree was upset again upon its side from off the sledge, and the sledge dragged forward. The tree was then allowed or assisted to right itself again in its proper berth, and friable earth packed well around and scattered over the stool, and a little litter spread over all. The ground was then drained and trenched, excepting the part around the tree, which had been stirred in the planting. If thought necessary, a prop or two were placed to steady the tree during the winter, as it might otherwise work a little back and forward with the wind while the clay was moist and soft. After the earth had dried in the spring, the props were removed.

When we look back on the description of this practice, it seems tedious; but much of the work is done sooner than described. Were it of sufficient importance, trees might be grown in something like *lazy beds*, with water always standing in the dividing trenches, about fifteen inches lower than the surface, which would procure roots very manageable by this practice. We once had a small nursery of oaks so situated, and the trees which were removed, when of considerable size, had roots uncommonly matted and fibrous, and which carried with them a large mass of soil. These succeeded very well when transplanted, but we should consider that plants from a drier poorer soil, with roots equally fibrous, would be preferable, could they be extracted with as much adhering earth, which, however, could not be accomplished without preparation and considerable labour. Were it the only consideration to procure plants which would best support the transplanting when of considerable size, this, or the practice of cutting the roots, and encouraging the rooting by manuring and thickening the earth around the stool, would merit attention; but as we have already stated, we consider plants with these matted roots not so likely to grow to large timber as those with several unchecked large diverging root-leaders.

Besides the above mentioned part of orchard, we have, by this practice, removed successfully (in some cases so much so as that no trace of the removal appeared), a considerable number of trees, where they were growing too close, and think it simpler, and much superior to Sir Henry's, wherever the stool of the tree can be turned up with a large cake of earth, as in cases where the greater part of the roots run out horizontally near the surface, which always occurs in flat ground, when the subsoil is soaking with moisture the greater part of the season. Whatever risk there may be of the tree not growing when it has been subjected to all Sir Henry's formal and tedious process, assisted by costly machinery, there is none here, provided it is placed in drained trenched ground, as a considerable number of the small fibres on which the suction of moisture for supply of the leaves depends, remain untouched, with this earth around them, and strike out immediately in the new moist soft soil; and there is no laceration of the main roots, which, by Sir Henry's plan, cannot altogether be avoided, this laceration being much more pernicious, and likely to occasion putrescency, than simple cross section *.

By the above sledging practice, we have successfully removed fruit trees 2½ feet in circumference, at two feet from the ground, and have had some 20 feet high, make a new addition to their height of six inches the first summer, where no shortening of the top had taken place. We have also plucked fair loads of fruit, both first and second season, as large

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* We think Sir Henry would find some of the failures of which he owns he cannot well ascertain the cause, but occurring especially in beech and oak, to be owing to a number of the lower roots, which are by far the tenderest, being bruised by the weight of the tree itself, when he turns it repeatedly over from the one side to the other, in order, by throwing in earth beneath it, to raise the root on a level with the surface of the field, the whole weight of the incumbent mass resting upon these soft roots. The oak, and still more the beech, are exceedingly susceptible to injury from cutting or bruises, and die far inward from the laceration. The wounded lower roots, especially when any vacuity is left not filled close in with earth, where mouldiness might generate in a dry situation, or when soaking in moisture for a part of the season, will become corrupted; the putrefaction thence gradually extending upward into the bulb, will contaminate the whole, and the second or third year after planting, the tree will be dead.

and well matured as any of the same kind produced by trees which had not been touched; but it is generally prudent not to allow them to fruit the first two seasons. As an experiment, we cut most of the branches from the top of two of the trees—that is, headed them down, but found these did not grow so well as those which were only slightly pruned, or not pruned at all.

Pruning at planting should take place in cases where there are long annual shoots of the preceding season, or much close spray as in old fruiting-trees; the former should be cut into five or six buds in length, and the latter ought to be thinned, to an extent, which the kind of tree, the largeness and safe state of the root, soil, exposure, and climate, must determine: we request our readers to pay attention to this. Pruning the long annual shoots, prevents a too early formation of leaves, which often occurs in moist cold soil, and which wither before the roots begin to strike.

In some cases, where we found the earth too friable, and not sufficiently bound together by the roots, to rise up in a cake, we first prepared the stool for upsetting, and waited for hard frost * to bind

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* We understand freezing the earth around the bulb is an old practice.

the earth and roots into a firm body like a large millstone, pouring some water upon it the evening previous to the commencement of the frost, that it might become firmer; we then proceeded with our sledging during the frost if the road was smooth; and, if rough, we covered over the frozen root with straw to retain the frost; and the first day of fresh, when the ground was soft and slippery above, and hard underneath, we proceeded with our work, taking care not to cover up the root with earth till it had thawed. We have found (contrary to general opinion), that no injury is sustained by exposure of the roots of various kinds of trees to frost, or as great cold as generally occurs at the surface of the ground in this climate. We have succeeded equally well with pear-trees, which had lain out on the exposed bare crown of a ridge for two months of winter, without the smallest quantity of earth adhering to the roots, or protection of any kind, as with those immediately from the ground where they grew. We have even thought that a certain exposure of the roots to cold increased their susceptibility to be stimulated to strike quicker by the warmth of the ground in spring, and thus the root suction coming to act sooner than it usually does in transplanted trees without balls, and nearer the time of the expansion of the leaves; the check occasioned by the upper [illegible] being [illegible] in the lower, was not so great. In some cases a slight degree of withering also appeared to have a great effect in deterring the development of the buds till the earth acquired a warmth sufficient in the next spring.

We succeeded better with those we transplanted by stripping, excepting a few which were placed among young trees obtained from a [illegible] nursery. These young plants brought along with them a number of the eggs of the common green caterpillar. These eggs produced larvæ upon the young trees the following spring; and these larvæ going down into the earth, produced a small grey silvery moth in July. The moths from the tallest plants being most opposed to them in their flight, or from being guided by common parasitical instinct to choose the largest subjects, deposited their eggs upon the removed old trees in preference to those on which they had been brought from the nursery,—a preference which did not seem to arise from any sickliness of the old, as they were fully as vigorous the first summer after transplanting as the young. These imported vermin prospering under the propitious dry warm summer of 1826, rendered several of the old trees as bare of foliage the second and third June after removal as they were in December; they have now, however, recovered their vigour, shaken off their parasites, and have produced good loads of fruit.

We may be thought fastidious in our tastes, and extravagant in our wishes, but we desire and expect more of our country gentlemen than to be mere idlers, or worse than idlers,—practisers of the *Allanton system.* When they turn their attention to forestry, we would have them to sow, or to plant from the nursery, and not to disturb and torture the fine growing timber which their fathers had located, and which generally suffers irreparable injury from removal,—a system to which Sir Henry Steuart is so absurdly attached, as to recommend its practice, although only *to turn the lee side of the tree round* to the wind in the same spot. Nor have we much sympathy with Sir Walter Scott's taste for home-keeping squires,—those Shallows and Slenders with whom our great dramatist has made himself so merry. We would have our landed gentlemen to know that *they* are the countrymen,—many of them, perhaps, of the blood of the Raleighs, the Drakes, and the Ansons. Let them, like our Wellington, our Nelson, our Cochrane, Wilson, Miller, and many others, continue to set before the world some little assurance of British manhood. Let them, like our no less honourable Penns, and Baltimore, and Selkirk, lay foundations of future empires. We would have our young men of fortune go abroad into the world as soon as their scholastic education is completed,—not to spend a few idle years in Paris, Rome, or other of the common enervating haunts,—they might as well remain in mother's drawing-room or father's stable; but to view man and nature under every appearance. Let them acquire horsemanship on the Pampas of La Plata; hunt the lion and the elephant, and other game, at the Cape, and study the botany and natural history of these prolific wilds. Let their ideas shoot while they recline under the lone magnificence of the primeval forest, while they gallop over the unappropriated desert, free as the Bedouin, or lie down composedly to sleep, serenaded by the hyena and jackal's howl, and lion's roar. Let them learn geology and mineralogy on the Andes and Himalaya, and around every shore where the strata are denuded. Let them wind about among those abrupt rocks and craggy precipices, where they may contemplate the sea-bird's household economy—the wild herbs of the cliff—the vegetation and shells and monsters of the ocean—the solitary white sail from distant land—the vestiges of olden time, the exuviæ of former worlds, in the exposed strata—the abrasion of the rocky land by the continued battering of the numberless pebbles moved backward and forward by the heaving of the ceaseless wave. Let them study the currents, and winds, and meteorology on the ocean, and enjoy the sublime feeling of riding over it in its wildest mood. Let them join the ranks of freedom in any quarter of the world where freedom is opposed to tyranny. Let them head the savage horde, and introduce the morality and arts of Britain among the ignorant barbarian; or lead out colonies of our starved operatives to new lands of high agricultural capability, where for centuries no population-preventive checks would be necessary. No other employment of life could be so abounding in heart-stirring emotion, as leading out the enthusiastic emigrants, with their huddled groups of children, whom you know you have rescued from the irksome unhealthy toil and wretchedness of the city manufactory; no occupation could be more delightful than cherishing the new-born settlement during the privations and hardships of infancy; in procuring a supply of food, when through mistakes, owing to ignorance of the climate and other circumstances, success had not attended their industry; and in leading them on to an effective self government. One would gladly leave this old world, whose surface is disfigured all over by man's patched drilled deformities, and pass on to a new one, where inviolated nature has produced and reared her own children after her own fashion, where every plant occupies its own place and blossoms in its own time. This order must afford intense delight to the naturalist, independent of the novelty of every thing, from the constellation in the sky to the lichen on the stone. In such a place, one should feel remorse to suffer the hatchet to work, or the ploughshare to enter in.

We fear these amusements (to which indeed, the British seem more disposed than any other people), would spoil all relish for the *Allanton system,* and that our travellers, on their return, would suffer the thriving trees planted by their fathers to remain at rest, and rather incline to introduce into the park some of their hardy foreign favourites—the iron-wood evergreens of Patagonia, the valuable pines and other trees of New Zealand and Eastern Asia. We believe, also, that an acquaintance with the real world, obtained in this way, would be much better fitted, than the following Sir Walter's recommendation, to render our gentlemen in after life able and ready to direct at the nation's councils, and to improve their estates, and the condition of their dependents. Perhaps they would then disdain to hang on at St Stephen's, the contemptible retainers (all but in livery) of some intriguing member of the cabinet, like hungry jackals (call-jack), for the pickings their master might leave them.

Having now looked at the general bearing of our subject, we shall approach it a little closer, to examine the facts, inductions, and minutiæ of the practice.

When we first heard of Sir Henry Steuart's celebrated discoveries and new system of moving about large live trees, and read Sir Walter Scott's declaration, that Birnam wood might now in reality come down living to Dunsinane, we were disposed to hold Sir Henry a magician, and were not a little alarmed lest grown up trees might indeed acquire, under his art, the locomotive power, and gallop about, to the no small terror and danger of his Majesty's subjects; but, on closer examination, we find all Sir Henry's art resolve itself into transferring them from one hole into another, by the labour of real men and horses, without injuring the trees to such a degree as preclude hope of recovery under proper subsequent attention. His mode of performing this may be stated shortly as follows :—

1st, Procure sturdy subjects, not drawn up tall and delicate in close plantations, but with short stem balanced all round with numerous compact branches, and well and regularly rooted, such as occur in open situation on level surface. If you have not trees possessing these *prerequisites* ready at hand Go prepare them. Thin out your young woods to double and triple distance, according as you intend to transfer them to sheltered or exposed situations; cut the roots of these trees, and trench around them at a few feet distant from the bulb, or lay down rich compost mould around them, to encourage exuberance of rooting, *and in eight or ten years* you will have fit subjects for removal!

2d, Prepare the site a year previous, by trenching and manuring with compost, carefully mixing and blending the whole (the upper and lower earth of the soil and compost), and adding mould when the soil is shallow; attending to thicken and mix clay soil with sandy mould, and sand soil with clayey mould, also guarding against lodgment of water. Recent farm-yard dung, peat-moss, and quick-lime, when well compounded together, make an excellent compost manure.

3d, Commence extricating your trees by opening a deep trench at the extremities of the roots, undermining a little inward, and gradually severing the earth from the rootlets, by stirring, scraping, and shaking with a very light pick, at the same time throwing the separated earth out of the hole, and working inward with the shovel underneath the bared rootlets, till the tree is so far loosened as to be upset by pulling on a rope fixed near the top, the rootlets, as extricated, being bundled up so as to be as much out of the way of injury as possible. Now, throw some earth into the hole; re-elevate the tree upon this earth, and upset it in the contrary direction; continue to throw in earth, elevate and upset in the contrary direction, till the bottom of the root be nearly on a level with the surface of the ground. Procure a large two wheeled wood-drag, and wheel it backward close to the standing tree. Elevate the pole of this drag, and tie it firmly aloft to the stoutest and most convenient part of the top. Make the body of the tree near the root fast to the axle, or to a beam raised a little above the axle, a pad intervening between the axle or beam and body of the tree, to prevent injury to the bark; then by pulling down upon the top of the pole, upset the tree upon the drag, balancing as near as possible upon the axle. All being now in readiness, attach your horses to the reverse end of the drag, where the root is swung, and have your plant pulled backward to its new berth, and deposit it carefully there, without any top-pruning, having its heaviest branches towards the west, that it may the better withstand our prevailing winds, taking great care to divide and comb out all the rootlets, and to pack in the fine prepared mould, so as to separate them nearly in the order they formerly occupied. Then *sad* down the whole by beating or watering, and mulch over all to exclude the drought.

4th, Water every two or three days in dry weather, during the early part of the first summer, and continue for several years to work over the surface of the ground by repeated hoeing or otherwise, till the tree has forgotten her rough treatment, and has become reconciled to her new quarters.

Now, this is Sir Henry's practice. What is there here meriting the name of discovery? All the world knew long ago, that trees drawn up tall and delicate, in sheltered situations, were unfit for an open exposure, especially when of considerable size. We have ourselves dug trenches round trees, and picked the earth from the rootlets with pointed instruments, preserving as far as possible every fibre entire. We have often collected fine mould and composts upon the ground previous to planting, and trenched over the soil; we have carefully arranged the rootlets, and packed in our prepared mould; we have noticed that mutilating the top of certain kinds of trees was very pernicious, particularly of the beech and the oak; we have invariably turned round the heaviest branches to the west; we have mulched and watered the first summer, and have hoed around the plants for years afterwards; conveyance by a two-wheeled timber-drag has been long in use (we have employed the axle and wheels of a common cart); many, before Sir Henry, have prepared the roots by previous cutting; what planter of experience is ignorant of all this? We grant Sir Henry has done all this well; much of it must have occurred to himself, as it has done to us, as it will do to any person of ordinary acuteness and observation, but does this merit the name of discovery, or comparison with steam and gas?

We shall now give some little attention to a subject on which we consider Sir Henry's claim to the rank of philosophic discoverer solely rests, and which he introduces to our notice certainly with sufficient prefatory flourish, under the designation of his "new principle," "his rational theory," which he predicts will raise transplanting of trees of considerable size to the rank of a useful art, it being thus founded on fixed principles. In order to bring the matter fairly before the mind of our readers, we are under the necessity of having recourse to a long quotation. We fear our readers will find Sir Henry's metaphysics not very intelligible; but this may well be forgiven, we are all too guilty of plunging about when we get into deep water, and some of us have not always sense enough to swim with the stream.

We here introduce a quotation of our author:

"But while every organic creation tends to full development, that is, to absolute energy, or perfect life, still we find, that the organs of which it is composed are each reciprocally dependent on every other, for the possibility and degree of their peculiar action. At the same time, as these internal conditions of animated existence are severally dependent on certain external conditions, which, again, are not always fully and equally supplied; so it follows, that the life of every organized being is determined in its amount, and in the direction of its development, by the outward circumstances of its individual situation. For this reason, we see that every animal, and every plant, is dependent for its existence, and also for its perfect existence, on conditions both internal and external.

"From this reasoning it may be conceived, how the several parts of the living whole reciprocally act and react. They are, in fact, cause and effect mutually; and no one can precede another, either in the order of nature, or of time. Thus in an animal, the digestive, and the absorbent, the sanguineous, the respiratory, and the nervous systems are at once relative and correlative. In like manner, in a plant, the same reciprocal proportion is found to exist between the roots and the stem, the branches and the leaves: Each modifies and determines the existence of all the others, and is equally affected by all in its turn. And as their several parts, by means of their union, constitute the organic whole; and as their functions, by the same means, realize the complement of life, which the plant or animal exhibits; it is evident, that every living individual is a necessary system, in which no one part can be affected, without affecting the other parts, and throughout which there reigns an intimate sympathy, and a complete harmony of perfection and imperfection.

" Further; The external conditions of the internal development of plants and animals are Food, Air, and Heat; while Light seems to be a peculiar condition, indispensably necessary to plants. Where any one of these conditions is not supplied, the existence of life, whether animal or vegetable, becomes impossible; where it is insufficiently supplied, life is proportionally enfeebled or repressed. But, to limit our consideration to the vegetable kingdom, it may be observed, that where a loose and deep soil affords an abundant supply of food, where a genial climate diffuses warmth in an adequate degree, and where a favourable exposure allows a competent access of light (for air, being fully and universally given, may be thrown out of the case); in these circumstances, a plant, if not mechanically injured, will vigorously exercise its functions, and attain the full development of its parts, thus realizing the absolute complement of life, to which it naturally tends. In the same way, when these conditions are stinted, the luxuriance of the plant is checked, in the ratio of that restraint, and the deficiency of the supply. Where any one of the external conditions is partially or inadequately supplied, the plant appears to make special, and even forced efforts to secure as much of the beneficial influence as it can, and to accommodate itself to the exigency of its situation. Thus, where light is admitted only from a single point, a plant concentrates all its powers, in stretching towards the direction of the light. Where light is shed all around, the plant throws out its branches on every side. In conformity with this principle, we find, that, in the interior of a wood, where the Trees mutually impede the lateral admission of light, the tendency of each is upwards; and the consequence of this tendency is, that the plant is thereby not developed in its natural and perfect proportions, but is elongated, or drawn up to an undue height. It displays its ramification chiefly near the top; while the imperfection of its life is manifested in the whole character of its vegetation. In open exposures, on the other hand, the tree developes its existence, in full health and luxuriance. It reaches a height, such as the soil and situation admit, and sufficient to allow the branches, which are thrown out on every side, to expand their leaves freely to the sun. Not being compelled to concentrate its efforts, in securing a scanty supply of one beneficial influence, all its proportions are absolute and universal, not relative and particular. In such circumstances, therefore, it may be considered as in a full and natural state of perfection.

"Another condition of vegetable life appears to be an adequate degree of Heat. Within a certain range of temperature, vegetation is positively promoted: Below, or above a certain point (the degree differing in different species of plants), vegetation is positively checked. To speak only of the latter case, which is briefly expressed by the term

Cold, it is either produced by absolute lowness of temperature, or, in particular circumstances, by the generation of cold, through the effect of wind, and consequent evaporation from a moist surface; for trees, in themselves, have but little self-generated heat, above the surrounding temperature. Some they certainly possess, otherwise they would be killed during severe frosts. Of the above accidents nature can modify the former, by accommodating different species of plants to different latitudes and elevations: Against the latter she adopts the plan of affording suitable protection to the individual. In the interior of woods, where the free current of air is intercepted, where stillness and serenity are maintained, and where each tree affords shelter, more or less, to every other, nature has little need to generate the provisions necessary to mitigate the injurious effects of evaporation. But, in open exposures, and in the case of isolated trees, this effect must be assuaged, and is, in fact, to a certain extent alleviated, by various provisions or properties, bestowed upon the tree itself. In the first place, a thicker and closer ramification of the sides and top is supplied, and a more abundant spray towards the stormy quarter, thereby furnishing a kind of clothing of leaves, in order to protect from cold both the ascending and the descending sap-vessels: And, secondly, a greater induration of the epidermis, and thickness of the cortical layers of the bark are provided; which, forming a bad conductor of heat, act as a still more effectual defence to the stem, by preventing the immediate and powerful application of cold, through the sudden subtraction of caloric, from the proper vessels of the inner bark.

"In this economy, nature only follows the analogy which she displays in modifying the influence of cold upon the animal kingdom. The quadrupeds, which are destined to encounter the severity of an Arctic winter, are provided with thick and shaggy coats, to enable them to withstand the intensity of the cold; and all the richest furs, which man employs to supply his natural, or rather his artificial wants, are always furnished by animals inhabiting the highest latitudes, and killed during the severest frosts. What is still more illustrative of the point under consideration is, that the coats of animals, of which the thin and short hair is familiar to us in the temperate climates, such as the dog, the fox, and the ox, are all remarkable, under the polar regions, for their close, lengthened, and almost impenetrable fibre, as a secure barrier of non-conducting matter, to prevent the escape of their vital heat.

"In like manner, in all the other relations, we see Nature especially accommodating the character of each individual plant, to the exigencies of its particular situation. In the interior of woods, the wind can exert a far less mechanical effect on individual trees; and therefore, while they are *positively* determined to push upwards towards the light, they are *negatively* permitted to do so, by the removal of any necessity to thicken their trunks, for the sake of greater strength, and to contract the height of them, in order to afford the blast a shorter lever against the roots. But, with trees in an open situation, all this is widely different. There they are freely exposed to the wind, and the large expansion of their branches, gives every advantage to the violence of the storm. Nature, accordingly, bestows greater proportional thickness, and less proportional elevation on trees, which are isolated, or nearly so; while their system of root, which, by necessity, is correlatively proportional to their system of top, affords likewise heavier ballast, and a stronger anchorage, in order to counteract the greater spread of sail, displayed in the wider expansion of the branches.

"Every individual tree is thus a beautiful system of qualities, specially relative to the place which it holds in creation; of provisions admirably accommodated to the peculiar circumstances of its case. Here every thing is necessary; nothing is redundant. In the words of a great philosopher, who was an accurate observer of nature, 'Where the necessity is obviated, the remedy, by consequence, is withdrawn.' If these facts and reasonings be correctly stated, the only rational theory of the removal of large trees consists, in prospectively maintaining the same harmony between the existing provisions of the tree, and the exigencies of its new situation, as had previously subsisted between its relative properties and the circumstances of its former site."

"In considering the characteristics of trees above mentioned, we should always bear in mind, that every production of nature is an end to itself, and that every part of it is, at once, end and mean. Of trees in open exposures we find, that their peculiar properties contribute, in a remarkable manner, to their health and prosperity. In the first place, their shortness and greater girth of stem, in contradistinction to others in the interior of woods, are obviously intended to give to the former greater strength to resist the winds, and a shorter lever to act upon the roots; Secondly, their larger heads, with spreading branches, in consequence of the free access of light, are formed as plainly for the nourishment, as well as the balancing of so large a trunk, and also for furnishing a cover to shield it from the elements; Thirdly, their superior thickness and induration of bark is, in like manner, bestowed for the protection of the sap-vessels that lie immediately under it, and which, without such defence from cold, could not perform their functions; Fourthly, their greater number and variety of roots are for the double purpose of nourishment and strength; nourishment to support a mass of such magnitude, and strength to contend with the fury of the blast."

"On the other hand, in the interior of woods, a universal tendency, for the reasons already stated, is observable in trees, to rise to the light, to attain greater altitude, to form far smaller heads, and taller, slenderer, and more elegant stems. Here is found a milder and more genial climate; in which, by means of the calm generated by shelter, vegetation is not checked by cold, and, at the same time, is undisturbed by the external impediment of wind; and nature has no need, as in the case of exposures, to generate provisions necessary to mitigate the effect of evaporation, as has been above observed, or to endue each individual tree with distinct and appropriate means of defence against the elements."

"That, as the four protecting properties, already delineated, as belonging to trees in open situations, are essential and necessary to the vigorous development of their existence, so they may be set down as indispensable prerequisites for those intended for transplantation, which generally implies increased exposure; and that soil and climate being equal, such subjects will succeed the best as are endued in the greatest degree with those prerequisites or properties."

"If we adopt this principle, and follow it up with a judicious mode of execution, it seems evident that the necessity of defacing or mutilating the fine tops of trees will be entirely superseded. *We shall obtain at once,* what the art, as hitherto practised, has not been able to obtain for us, the Immediate and Full effect of Wood, that is, *Trees complete and perfect in all their parts,* without the loss of the time required to replace the parts so defaced and mutilated."—"And if such a mode of execution be superinduced upon it, as shall furnish to the tree a competent supply of sap at the critical period of removal, the art probably may be said to be established on *fixed principles.*"

"Wind being, in a great degree, excluded in unthinned plantation, and evaporation prevented, heat is, by consequence, generated in an undue degree.

In the same way, light is nearly shut out from such plantations, except from the top, and a disproportionate elongation of the stem is occasioned *by the efforts which each individual makes to gain the light.*" P. 191.

Now, what do we gather from all these *discoveries* which, in continuation, our author turns round and round, and exhibits to us under every combination, with admirable elegance, it must be allowed, like the objects in a kaleidoscope?—that trees grown in sheltered situation are not suited for exposed situation, because their roots are proportionally too small, and the stem too long for stability under the strain of high winds; their exterior bark or epidermis, dead and living, too thin to afford protection to the sap-vessels from cold, the effect of evaporation caused by the wind; their spray and leaves too elevated and open to exclude the cold, or wind generating cold, from the stem and branches. That the reverse coexistent conditions of trees in open situation—short stout stem, thick bark dead and living, strong rooting, close cover of spray and leaves all around, befitting the plant to withstand the tempest, and affording shelter to the sap-vessels of the stem and branches—and these conditions being want-ing when redundant in sheltered situation, show the beautiful adaptation of means to end, like warm fur of animals in cold countries: That trees being formed to grow tall in close situation, is a beneficent provision of Providence for accommodating man with straight long clean deal and beams: That trees shoot tall in close situation because they strain hard to reach the light: That trees shoot tall in close situation from warmth: That shelter and exposure is heat and cold: That, "to establish any just analogy between the transplanting of young and of old trees is utterly impossible:" That these conditions of trees being thus explained to mankind, and followed up by judicious execution, the thing is reduced to fixed principles, and raised to the rank of an useful art, and the necessity of defacing, or mutilating, the fine tops of trees, when transplanted, entirely superseded.

We shall now attempt to weigh some of these assertions and conclusions of Sir Henry, and to pursue these inquiries a little farther.

It is known to every forester, that trees growing in close order, and drawn up tall, will not continue healthy on being thinned out to very open arrangement, but will often fall victims to the change of circumstances, even though they withstand the gale. Who, then, would be guilty of the folly of expecting they would bear exposure and the injuries of transplanting at the same time? Sir Henry Steuart mentions some particular facts as causes of this unsuitableness. Perhaps it would have been as well to ascribe it to general inaptitude and delicacy, as there are several other circumstances not easily understood, such as vital stamina, habitude or acclimatizing, and texture and configuration of vessels, which must have influence. We should also think simple evaporation of the fluids of the transplanted tree a much greater cause of its failure than the cold of this or of any other evaporation acting to numb the sap-vessels in the stem and branches. The absorbing mouths of the rootlets, excepting in the case of very large balls, are generally destroyed by the operation of removal; and the development of the leaves to a certain extent taking place before any new process of striking of the roots, owing to the atmosphere and branches getting sooner heated in spring than the ground and roots, the half-developed leaves shrivel up in the arid spring air, from the evaporation of the juices and deficiency of root-suction; and when the air gets moist, showers fall, and the earth becomes warm enough for the *striking* of the roots, the vital principle is too far spent, or the material substance too much changed, for the recommencement of organic action. We have found that trees which had remained months out of ground, and were planted in March, succeed better than trees removed immediately from their old site to their new, both being planted with equal care in the same ground at the same time. The latter acquired half developed leaves early in April, which withered from deficiency of root-suction; and it was only with attention that we succeeded in causing them to bud forth anew and acquire leaves about midsummer; in several, we stimulated the root-suction by application of heated water, covering up with litter to retain the heat. The former were several weeks more backward in leafing, and when the buds burst, the ground had become warm enough for *root-striking*, and the vegetation proceeded without check. Sir Henry will say, that the check sustained by those which leafed early, was owing to the numbing effect of the cold spring wind, and of the cold of evaporation on the sap-vessels of the stem; but we had caused several of them to be wrapped round the stem with soft straw-ropes, and this did not prevent the shrivelling of the leaves, although it certainly protected the sap-vessels from the cold. This withering of the leaves of transplanted trees, by which large transplanted trees so frequently perish, is most prevalent in cold damp soils, when the air is dry and the sun powerful, and evidently results from the superior vegetation being in advance of the inferior; torpor of the roots, not torpor of the sap-vessels of the stem from cold. It is also perfectly evident, that trees with long naked stems will suffer most, as their leaves are raised higher, more in the current of the drying wind; their root and top farther asunder, therefore less liable to contemporaneous impulse; the sap-vessels of the stem longer and more attenuated, therefore the streams of fluids from the soil, not only smaller, but also more liable to obstruction, or to flow slowly, from the insufficiency of the vital impulse, or of endosmose in the wounded sickly plant to impel to such a height. Our author's assertion, that the rough epidermis generally covering the live bark of trees in open situations, is necessary to the health of the tree, in protecting the sap-vessels from cold, is, we think, not quite correct. Some time ago we caused the dead epidermis be hewn down from several trees, in a rather exposed situation. This was done with considerable nicety, and extending up along the branches. We remember of one case, of very thick indurated epidermis, where a carpenter was employed more than a day in laying bare the live bark of one tree.

Instead of suffering injury by this exposure of the sap-vessels to cold, the trees rather acquired new vigour from the operation; and the particular tree alluded to, was unusually luxuriant the season following this flaying, which was performed in winter. Now, to apply Sir Henry's analogy of fur of animals, would an arctic fox have been benefited by exposure to the winter's cold in like plight? We also think Sir Henry will find the trees of dry climates have a much thicker coating of dead bark than in cold countries, evidently a consequence of desiccation*, and, if Sir Henry must have animal analogy—similar to the desiccation and cracking of the skin of man in arid air.

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* We particularize the oak, cork-tree of arid warm Spain, and much of the timber of New Holland. Owing to the hot parching air in the latter place, the epidermis becomes dried to such a degree, that contracting by the drought, and bursting by the swelling of the enveloped stem, it peels off like the old skin of a serpent, and is often seen hanging upon the tree in large shreds like tattered garments. In several kinds of trees, we have counted regular annual rings of desiccated bark; in some kinds this appeared a growth or deposition, in others, mere parched exuviæ. Trees attain some age before the *exuviæ* commence; the *deposit* begins the first season, even in sheltered situations. The cork-tree, and the small-leaved elm, shew the greatest annual deposit of dry bark. The former does, and the latter is said to belong to warm arid countries; both form a better nonconductor of heat than any other dry bark we are acquainted with—infinitely better than the bark exuviæ of trees which approach the polar regions.

It is a subject of considerable difficulty to explain the cause of slender lengthened shoots in sheltered situations, and short stout shoots in exposed. Sir Henry solves this "excellently well" in two ways, first, attributing it to shelter and exposure themselves,—"for shelter is heat, and exposure cold,"—and again, to an instinctive straining in the sheltered to reach the light, of which its neighbours deprive it every way but from above, and would do so there too if it failed to exert itself.

We find that vegetables have long spindling shoots, and wide spaces between the leaves or buds, when growing in a damp, still, close atmosphere, especially when the plant is sickly or weak from deficiency of nourishment, and that this happens equally, whether a trailing plant being supported aloft throws out depending shoots in opposition to the current of light; whether a climbing* plant runs out horizontally along a branch or beam at right angles to the light, or whether a self-supported mounting plant rises in direct opposition to gravity. No doubt, when the light comes from one direction, such as the aperture of a window, the plant shoots forth towards the light, possibly in consequence of the leaves inclining themselves to receive the ray on their superficies, and thus leading the shoot in the direction of the light. But this does not prove any straining or lengthening of the shoot to approach the light; and we ask, what do general opinion and Sir Henry found their belief upon, of lengthening growth and straining to approach the light?

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* We do not pretend to explain how it is, that one kind of climbing plant follows the sun in its convolutions, and another traverses his course. There surely cannot be any thing in a habit acquired in the southern hemisphere.

Again, with regard to heat, we notice that plants, particularly shoots from tubers, left to sprout in cold, damp, confined cellars, throw out very long stems, with wide spaces between the buds or leaves, and that very long shoots always occur in confined damp air—long in the ratio of the dampness and confinement, whatever the degree of heat may be, provided it exceed a little the vegetating point. Also on the north side of hills, the trees have generally longer stems than on the sun-ward side, although in the former case, they are exposed to the northern blast, while in the latter they bask in the sun. Has the same kind of plant, in lower latitudes, longer spaces between the leaves than in higher? And if it has not, is the cold, from greater evaporation, sufficient to balance the superior heat of the climate?

The above facts must lead, we think, to the conclusion, that evaporation, or non-evaporation, of the fluids, has, directly, a very considerable influence in causing a shorter or longer extension of the shoot between the buds or leaves, and that the influence of the cold of this evaporation is at most but of a very secondary character. We would compare the extending rudiments and matter of the young scion to the slow flowing of a gelatinous fluid. In moist air, the watery part is slowly evaporated, and the drop extends into a long pendulous form. In dry air, the water of solution is quickly evaporated, longitudinal extension ceases, and the pendant is thicker and shorter. The cold of evaporation may a little affect the fluidity, but only in a very small degree *.

The causes of the elongation of vegetables are,

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* In proceeding further on in Sir Henry's volume, we have noticed an excellent observation quoted from Du Hamel: "The extension of the shoot is inversely as its induration, rapid while it remains herbaceous, but slow as it is converted into wood. Hence moisture and shade are the circumstances, of all others, the most favourable to elongation, because they prevent induration or retard it." Although quoting this, Sir Henry recurs to his old opinions, and proceeds to observe, "Trees so circumstanced, push upward to the light; and from the warmth which their situation affords, their stems being thin and slender in proportion to their height, they are destitute of strength to resist the winds."

however, not very plain. We have noticed, that the deeper the seed is placed in the ground, the braird rises the higher above ground, even when the seeds at the different depths have been equally moist. This might admit of explanation, but having already occupied too much space with this subject, we shall only remark further, that in close woods, the trees elongate, because they are precluded from extending laterally. The top buds, from receiving more of the stimulating or nourishing influence of the dew, sun's rays, fresh unvitiated air, invigorating motion of the winds, and perhaps of electricity *,

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* We do not mention temperature, because we are not in possession of facts sufficient to lead us to form an opinion on the subject. Judging from animal analogy, of which our author is so fond, we notice, that those animals exposed in open atmosphere, have generally warmer blood than those who lurk in holes,—even than those of the same species who happen to live under shelter. Now evaporation takes place from animals as well as from vegetables, and the consequent cold is more than balanced by the heat of what may be termed the vital fire, which, like most other fires, burns brightest on exposure to a current of atmospheric air, being increased either by the result of the new chemical combinations having less capacity for heat, or by the stimulus of the fresh moving air exciting the vital action. Of the general influence of close forest on temperature, we are also not very well assured; but the few facts which observation has afforded, lead to the opinion, that to the northward of 50 deg. Lat. forests have higher temperature than bare country; that from about 50 to 30 degrees Lat. forests are cooler in winter and warmer in sum-

throw out a greater continuation of shoot than the under branches; nearly the whole nourishment from the soil being on this account drawn up and consumed by these top shoots, and the lower overshadowed twigs and branches languishing and dying from the absence of these advantages. Besides this extension of top shoots, by the greater continuation of leaves, or links of life, occasioned by the above causes, these shoots, owing to the moist atmosphere of the wood, also push out into longer spaces between the leaves. However, these top branches do not push sun-ward, but merely in opposition to gravity.

Sir Henry states, that "trees certainly possess some heat, otherwise they would be killed during severe frosts." Our belief of the vital heat of vegetables is placed on a much better foundation than

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mer; and that nearer the equator, forests are generally cooler than bare country. But the temperature is regulated so much by the position of seas and lakes, in combination with the prevailing currents and strength of currents of the air—by the configuration of the country,—moisture and cloudiness of the atmosphere and quantity of rain,—by the composition, arrangement, and colour of the soil,—by the lower vegetable cover, and even by the nature of the forest itself, whether deciduous or evergreen, that particular facts must be very carefully weighed to enable us to reach general conclusions. It is generally understood, that forests render the climate moister.

this *otherwise;* otherwise our credence would be far from philosophic. Freezing cold affects many vegetables as well as some of the lower animals, only by mechanical injury, in rending the vessels by means of the expansion of the contained fluid. Now, if these vessels are not quite full of fluid, if the fluid be of such a nature as not to congeal into greater size, or if the body be small, and the vessels elastic, to yield to expansion without fracture—the vegetable or animal will often resume vitality, on being thawed from thorough congelation. We have rendered potatoes, turnips, and fruits, frost-proof, at least unless the frost was intense, by a slight desiccation caused by exposing them a short time to the air after being taken from the ground or tree*. In the cases where fishes and reptiles have been found frozen so hard as to require a hatchet to dissect them, and reviving on thawing, it will be found that the fluids were principally oleaginous, which do not expand in congealing; and in the case of insects being frozen in masses during the night, and resuming their liveliness next day in the sun, we think, if their fluids have congealed at all, that either the vessels must have yielded, being elastic (which might more likely take place in a small body, without general fracture and derangement), or that the fluids had not extended by being congealed; but it is very probable, though frozen together in a mass of water and mud, that their fluids, from being of an acid nature, had resisted the congelation.

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* Our experiments have not yet been carried so far, as to determine if, by any arrangement of drying or exposure, they may be seasoned to sustain intense frost, which may affect them differently from moderate frost, either by causing complete congelation of all their structure (moderate freezing appearing only to congeal their fluids, but not entirely the containing vessel, at least only partly congealing the mass), or by killing the vital principle itself through nervous affection. The potatoes became green from the exposure to the light, and we rather think acquired greater hardihood of constitution, or greater vitality or excitability by the exposure, thence greater power to resist the cold, independent of the disposition they acquired by desiccation to endure it.

With regard to trees, we have heard that intense frost often splits the trunks of some of our indigenous kinds by congelation *; but these trees retain vitality, and only suffer from the consequences which may ensue from the fissures. We have seen evergreens, plants from milder climates, and trees which had not thoroughly ripened their

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* Is the rending of the stems of trees, during intense frost, internal only, and occasioned by the alburnum expanding more by congelation than the drier mature wood? or, is it external, and caused by the contractile effect of the dry air and cold on the alburnum rendering it insufficient to surround the mature wood, which, from dryness and want of living susceptibility, may not contract so much.

wood (that is, retained the vessels full of moisture), injured in the extremities, and even killed throughout by cold. But this does not prove that these had any vegetable heat, any more than those which suffered no injury from the same degree of cold, prove that they had vegetable heat. The juices of some kinds of plants do not congeal at the same point of temperature as others. The vessels of some in winter are not so much distended with fluids as others; and probably the vital principle of some is less susceptible of injury from cold than others. These facts may account for the endurance of intense cold by some kinds of trees, independent of vegetable heat.

Our author, speaking of the transplanting of fruit trees, states, that "any gardener could have predicted the probability of fruit during the first season, together with [the certainty during the second of its not taking place." Our gardeners will be moonstruck at having the gift of prophecy attributed to them, at least to predict in such a way. We have thought Sir Henry sufficiently ready to impute ignorance to gardeners before we came to this remark; but to represent a useful and intelligent class of men in so ludicrous a light, is certainly using a very improper liberty.

Every gardener is aware that trees will fruit the first season after transplanting, just if they have had the rudiments of the fruit formed in the bud before transplanting, and should the blossom not be injured by severe weather. Every gardener is aware, though Sir Henry seems not, that all fruit trees, of any size, form these rudiments the season after transplanting, and that they invariably fruit the second season, if the season suit the fruiting of the kind; and every gardener of any experience is capable, even without Sir Henry's instructions, of removing a fruit tree of considerable size, without injuring it so severely as to prevent it fruiting both first and second season, which it will do, and even mature fine fruit both years, though during the first, under very unfavourable circumstances, it should scarcely be able to develope leaves 1-5th of the usual size, and though these leaves wither and drop off long before the summer is ended, while the fruit remains to ripen on the tree. This is *a direct consequence of evaporation.* The thin leaves shrivel up in the ardent sun from evaporation and want of sufficient supply by root-suction; and the bulbs of the fruit, from their massiveness, contain sufficient moisture to resist withering till the night, when they drink the dews, and suck up some little moisture from the roots, undiminished by evaporation in the transit, to replenish the daily loss.

Sir Henry remarks, that "no man who knows any thing of wood, will put down the oak or the elm on light sand or gravel, as it is only on deep loam and clay that the oak, in particular, will really thrive and grow into timber." No man who knows *how much a suitable soil for any kind of plant is under regulation of the moistness or dryness of the atmosphere, and other circumstances,* will refrain from smiling at Sir Henry's very superficial acquaintance with his own subject, and at the manner he thus again brings forward mankind to testify in support of his own error. Our author will place the above quotation among the errata should he take a ride up Strath-Tay from Birnam to Kenmore.

Among other items of expense given by our author, none of which seem to be overstated, we feel grateful for the information, that compost manure of lime, farm-yard dung, and moss, can be obtained, compounded, fermented, conveyed and applied, at the rate of 6d. and 9d. per single and double load!

Sir Henry makes good his assertion, that slow grown timber is always stronger, denser, and more durable than fast grown, by a cloud of witnesses,—every forester, gardener, and carpenter of the country, is ready to attest it of course! There are few sublunary matters which admit of evidence more conclusive. We quote his account of this uniform "law of nature."

"The same general law operates in a similar way on all woody plants, but of course less rapidly, owing to the less rapid growth of trees, from the lowest bush to the oak of the forest. In all these, the culture of the soil tends to *accelerate vegetation*, and by consequence to *expand the fibre of the wood.* It necessarily renders it softer, less solid, and more liable to suffer by the action of the elements. Let us shortly give a few examples of the uniform effect of the law of nature.

"Every forester is aware how greatly easier it is to cut over thorns or furze that are trained in hedges, than such as grow naturally wild, and are exempt from culture. Gardeners experience the same thing in pruning or cutting over fruit trees or shrubs; and the difference of the texture of the raspberry in its wild and in its cultivated state, is as remarkable; for although the stem in the latter state is nearly double the thickness of that in the former, it is much more easily cut. On comparing the common crab, the father of our orchards, with the cultivated apple, the greater softness of the wood of the latter will be found no less striking to every arboriculturist.

"Further, the common oak in Italy and Spain, where it grows faster than in Britain, is ascertained to be of shorter duration in those countries. In the same way, the oak in the Highland districts of Scotland or Wales, is of a much harder and closer grain, and therefore more durable, than what is found in England; though in such mountains it seldom rises to the fifth part, or less, of the English tree. Every carpenter in Scotland knows the extraordinary difference between the durability of Highland oak and oak usually imported from England, for the spokes of wheels. Every extensive timber-dealer is aware of the superior hardness of oak raised in Cumberland and Yorkshire, over that of Monmouthshire and Herefordshire; and such a dealer in selecting trees in the *same* woods, in *any* district, will always give the preference to oak of slow growth, and found in cold and clayey soils, and to ash on rocky cliffs, which he knows to be the soils and climates natural to both. If he take a cubic foot of park-oak, and another of forest-oak, and weigh the one against the other (or if he do the like with ash and elm of the same description), the latter will uniformly turn out the heavier of the two."

It is certainly the case, that luxuriant growth increases the size of the sap-vessels and cells, but with this increase of size, there is often a proportional increase of thickness of the sides of these vessels and cells, and a greater than proportional filling up of dense matter, as the alburnum is better ripened in autumn, or as the mature wood, especially of hard wood in dry situations, ripens more slowly in the course of years. ' There is also in many kinds more of close tissue and cellular part, in proportion to large sap-vessels, when the tree is growing vigorously than when it is stunted. (See the facts in our notice of Withers, p. 199.) *Thence culture does not necessarily render the timber softer, less solid, and more liable to suffer by the action of the elements.* We are really angry with those smooth-tongued rogues who " fool us to the top of our bent." *Every artificer* who has worked slow grown ash of considerable age, that is, when most of the timber has been deposited after the tree has been seeding strongly, *assures us* that the timber is very inferior, in all respects, to that of quicker growth.

We consider the forester who has observed that thorns or furze trained in hedges are much easier cut from softness of timber than when growing in detached bushes, a much better observer than ourselves; and we would inquire whether he were certain that the greater efficiency of his blows was not owing to their being better directed, from the conveniency of access, owing to the training up, than from the timber being softer? The example of the raspberry we consider very irrelevant, it being only a semi-herbaceous plant of biennial stem.

Gardeners certainly experience the branches and roots of crab-apple to be harder than the varieties with thicker bark, larger more downy leaves, and larger fruit. The largest growing apple varieties, however, are not the above mentioned mild varieties, but those which have a pretty close approximation to the crab. We have taken slips from some of the very largest of our pear-trees, and having placed them close to the ground on young stocks, have found they threw out spines and rectangular branching similar to crabs. Those most dissimilar to the crab have thick annual shoots, without any lateral rectangular branching, and very thick bark; they have been gradually bred to this condition by repeated sowing, always choosing the seed of those partaking most of these qualities for resowing, their disposition to vary to mildness being at the same time influenced in some measure by culture and abundant moist nourishment; but these mild varieties, although they throw out a strong annual shoot while young, seldom or never reach to any considerable size of tree, unless they are nourished by crab roots, their own roots being soft and fleshy, and incapable of foraging at much depth or distance. Their branches and twigs as they get old, are also very soft and friable, covered with a thick bark, but the timber of the stem is very little inferior in hardness to crab timber.

We ask, if even the fact of these unnaturally tender varieties (obtained by long-continued selection, probably assisted by culture, soil and climate, and which, without the cherishing of man, would soon disappear), being of rather more porous texture of wood, goes any length to prove our author's assertion? We have paid some attention to the fibre of the genus Pyrus, and find that the Siberian crabs have by far the smallest vessels. Having grafted the large Fulwood upon the smallest Red Siberian Crab, or Cherry-apple, the new wood layers above the junction swelled to triple the thickness of those below. By ingrafting other kinds upon other stocks, we have found the reverse to take place, no doubt owing to those with largest vessels swelling the most, there being the same number of vessels above and below the junction, each corresponding, or being a continuation of the other [*]. But this small Siberian crab, when ingrafted upon a common crab, grew fully as quickly during several years as the Fulwood under the same circumstances; and the timber, though of much finer texture, scarcely exceeded the other in hardness. Sir Henry tells us, that the oak is less durable in Italy and Spain than in England [†]. We tell Sir Henry, that the red-wood pitch-pine from Georgia and the Floridas, on the confines of the torrid zone, is more durable than the red-wood pine from Archangel, on the confines of the frigid zone. But does this fact regarding the oak of the south of Europe, prove any thing regarding the oak of England,—that it will always be deteriorated by culture for several years after planting, or that the quality may not suffer as much from slowness of growth as from fastness, or from the climate being too cold as from being too warm?

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[*] The fineness of vessel or fibre of the Siberian crab, may be induced by the arid warm air, the continued radiation of heat and light upon the portion above ground, and the coldness of the ground around the roots during the short summer in Siberia, where the air and surface of the ground is warm, and vegetation progressive, while the ground remains frozen at a small depth. Like all varieties of plants habituated to colder climate, the Siberian crab developes its leaves under less heat than varieties of the same kind which have been habituated to milder climate.

[†] We have not taken Sir Henry in the literal sense. Timber is well known to decay sooner in a warm than in a cold country, *cœteris paribus.*

The reason why Highland Scots oak spokes are superior to English, is, because the latter are generally split from out the refuse of the timber cut for naval purposes,—principally *the branches and tops* of large trees; whereas, those from the Highlands of Scotland are from *the root cuts* of copse. We believe most carpenters of Scotland are aware of this. The oak from the Highlands of Scotland is, however, for the most part, of excellent quality, growing generally on *dry gravel and rock*, not on cold moist *clayey soils.* The hardest we have ever seen was from a steep, dry gravel bank, of south exposure, in an open situation, much exposed to the western breeze. The Highland oak from these soils is generally of a greyish colour, and very dense; whereas that from moist soils is often reddish-brown, and defective. Should Sir Henry weigh portions of oak from these soils in a pair of material, in place of mental scales, we think his conclusions would be somewhat different.—The strongest, hardest ash we have seen, was cut from a hard, dry, adhesive clay, of course a young tree.

Sir Henry, speaking of the Western Highlands and Islands of Scotland, states that "it is from a want of soil, and not of climate, that woods of any given extent cannot be got up in these unsheltered, but romantic situations." Of many situations of these bleak districts, this must be admitted, but we cannot receive it as a general fact; and even where it holds true, the want of (proper) soil, or formation of peat, is a *consequence* of the want of climate, although *this* may have reacted to increase the evil. There must have been a greater warmth of climate, at least in summer, when the forests grew, which lie buried in the mosses of the northern part of Scotland, and of the Orkney and Shetland Islands, as some kinds of timber are found in situations where such kinds, by no circumstances of gradual shelter under the present climate, could have grown. There are several indications of a greater warmth having been general throughout Britain, and even farther eastward, and that a slight refrigeration is still in progress. We instance the once numerous vineyards of England,—the vestiges of aration so numerous upon many of our hills, where it would now be considered fruitless to attempt raising grain, even with the assistance of modern science; and the report that the Caspian is gradually overflowing her shores, a probable consequence of diminished evaporation from decrease of heat.

That this is not wholly owing to the moisture and cold consequent to the moss formation, or to any cover or want of cover to the earth, of timber, or of any other plants which might possibly have effect upon the temperature by shade, evolution of vegetable heat, electric or meteoric agency, we think proved, should the asserted fact be correct, that, in the small *oes* of Shetland, (so distant from any considerable portion of land as not to be under these influences, and so small, that the climate must be solely dependant upon the sea), timber is found in the morasses, although the climate will not now admit of timber growing, being apparently equally deteriorated as that of the Mainland. It is not improbable that the superior former climate of the North of Scotland and Islands was owing to their having formed, at one time, an extensive country, perhaps joined to the continent, and thus partaking of the continental climate, that is, having a colder winter and warmer summer, capable of producing considerable vigour of arboreous vegetation, and not so favourable to the generating of that fixed vegetable incubus, peat-moss, who has crept over, and folded in her chill embrace, the once fair districts of northern Scotland. The fogs and more steady low temperature of insular situation, which now prevail, not only induce that chemical change in dead and dying vegetables which forms peat-moss, and preserves this moss from decay, but also being too cool for the vegetation of the gramineæ, &c. tend only to promote the general spread of sphagni and other moss-generating plants, which, again, are almost the only plants that can vegetate on acrid moss-flow, as they draw little or nothing from below, and are nourished directly by the moisture and other fluids of the atmosphere.

Our eastern shore affords sufficient proof that the ocean has both receded and advanced recently—at least recently in comparison with the great changes which have occurred to modify the surface of the earth. In proof of this recession, we have the upper *carses*, or deltas, visible in every firth or creek where a river falls into the German Sea. These carses, on the firths in Ross-shire, at Dun near Montrose, around the upper end of the Firths of Tay and Forth, are all of nearly equal level, about 20 feet above the highest stream-tides. The gravel bar at Montrose is considerably above the present sea-level. A number of caves exist on this eastern coast, evidently worn into the rock by the action of the sea at the height where the waves have broken. These caves have nearly one level, corresponding in height with that of the carses. There are also many places where the coast has been shorn away by the action of the waves, and a shelf of rocks left extending out some hundred paces. This abrasion, which takes place nearly at, or a little above, low water-mark, is effected by innumerable hard pebbles (the most indurated parts of the rocks which give way being converted into battering material for further reduction), being upborne and dashed against the rock by the continuous heaving and lashing of the waves. Wherever any breach commences from the feebler opposition of any softer part, the action of the waves and battering train proceeds with increased impetus and concentration, especially if the breach be wedge-shaped narrowing inward, thence caves of considerable extent are hallowed out. The rocks thus abraded and undermined, tumble down and are ground into sand, which is swept by the tides and motion of the waters into the depths of the ocean, or borne along to the upper end of the bays, or to some part of the coast where more sluggish lateral tides, and particular motion of the waves leave it and throw it ashore to be blown up into downs. There are some former islands which have been altogether shorn down to this sea-level, of which the Bell-Rock, extending nearly a mile of shelf, affords a well known specimen. In many places of the coast, these shelves accord with the superior former level of the sea, and with the floors of the caves.

In proof of the sea having advanced upon the land, there are vestiges of submerged forests (the stumps of the trees standing erect where they grew, at or a little above the present lowest ebb) existing at different places on the eastern coast, both of England and Scotland, and these vestiges standing upon a former carse or alluvium of the rivers, are visible in the same firths with the upper level of carse, of course generally more to seaward than these higher carses, as deposition of rivers occurs at what may be termed deposition point, that is where the rivers, from the stemming of the sea-water, begin to widen —where the firths commence; and the slowness of the motion of the water gives time for the subsidence of the floated mud. By reason of the flux and reflux of the tide into the mouths of rivers, this deposition takes place only at or near high water, that is, when the strength of the inward tide-flux ceases, and before that of the reflux begins. It is most abundant at the windward shore, or where there is least surf, and among the tall gramina and other vegetation where there is least undulation and current; the deposition which occurs at this time, some distance below high water level, is floated away by the current of the following flux and reflux, unless some object afford a nucleus of formation. Hence deltas or carses usually form near the shore of firths, generally soon rise to high-water level, and have often steep, or even abrupt, banks, collecting at one place, and giving way before the waves and undermining current at another. There is a deposition of another kind than river diluvium, which also takes place at the bottom, or further end, of bays and firths, and is sometimes mixed with the preceding: This consists, as mentioned above, of the abrasion of the rocks, or shores of the bay and neighbouring coast, and also of molluscous exuviæ, borne along by the motion of the waters; but this is generally rather an accumulation than a deposition, occurring in greatest quantity where a heavy swell rolls dead in.

Although we have pretty accurate proof that the present elevation of the German Sea has remained nearly steady for several hundred years, yet our new formation of carse, at the present high-water level, bears a small proportion to the extent of the upper carse; from which may be inferred, either that the sea has remained a shorter time at the present level, or that some general cause has more recently operated to diminish the deposition, such as inferiority of present climate not producing so much littoral vegetation,—tides or higher winds preventing subsidence by greater undulation or current, till the diffused mud be carried out to sea *. The junction of the higher and present sea-level carses, abrupt and always definite, that is, not gradually declining from the one to the other, would seem to indicate a quick subsiding of the sea, or rising of the land, such as has been known to result from subterraneous derangement. The very accurate level of these carses proves, that this portion of the world has remained a very long time pretty free from these disturbances, recently so prevalent in some other quarters; and if the change of sea-level has been owing to such disturbance, it follows, from the extent and regularity of the upheaving or subsidence, that the cause must have been very deep seated, or of great magnitude.

We begin to think, from our disposition to ramble from the Allanton system, that we tire of Sir

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* See Appendix F.

Henry; and we believe, should *he* follow us thus far, that he will be tired of us. On looking back on what we have written, we are almost disposed to accuse ourselves of being splenetic; but the truth is, we regard the whole art as very unimportant, if not positively pernicious, at least in the way in which it has been exemplified by Sir Henry, as a throwing away of valuable labour to no purpose, if it ought not indeed to be considered as a mere pander to luxury and caprice. We have no sympathy with the aristocratical object of the book, and as little with the aristocratical tone in which it has been bepraised by Sir Walter Scott. We should also have no greater pleasure in the discovery of a royal road to virtue than we should have to the discovery of one to science,—the four cardinal virtues being, as every body knows, writing books, building houses, and raising trees and children, but we should hope, neither by proxy, nor by the *Allanton System.* While, however, we thus state our opinions with freedom, we do not hesitate to add, that Sir Henry's volume has afforded us more information, or, at least, more materials for reflection, than any other of the works which we have brought under the notice of our readers.

We shall finish our remarks on Sir Henry's work, by making some observations upon a quotation made by Sir Henry Steuart, from "A Treatise on the Forming and Improving of Country Residences," by the Author of the Encyclopædia of Gardening, &c.—an author, who combines talent, successful industry, and enlightened benevolence, in no common degree. We are sorry to appear before this author, whom we have long esteemed, in opposition; yet we regret the less, as we consider him one of the few who prefer accuracy and truth to an old opinion, and whose name stands too high to be affected by a casual misconception.

"The general effects of pruning," says this author, as quoted by Sir Henry Steuart, "is of a corresponding nature with culture, that is, to increase the quantity of timber-produce: the particular manner in which it does this is by directing the greater part of the sap, which generally spreads itself into side branches, into the principal stem. This must consequently enlarge the stem in a more than ordinary degree, by increasing the annual circles of the wood. Now, if the tree be *in a worse soil and climate than those which are natural to it, this will be of some advantage*, as the extra increase of timber will still be of a quality *not inferior* to what would take place in its natural state; or, in other words, it will correspond with that degree of quality and quantity of timber, which the nature and species of the tree admit of being produced. If the tree be in its natural state, the annual increase of timber occasioned by pruning, must necessarily *injure its quality* in a degree corresponding with the increased quantity. If the tree be in a better climate and soil than that which is natural to it, and at the same time the annual increase of wood be promoted by pruning, it is evident that such wood must be of *a very different quality* from that produced in its natural state (that is *very inferior).*"—"*Whatever tends to increase the wood in a greater degree than what is natural to the species when in its natural state, must injure the quality of the timber.* Pruning tends to increase this in a considerable degree, and therefore it must be a *pernicious practice.*"—"Mr Knight has shown, in a very striking manner, that timber is produced, or rather that the alburnum or sap-wood is rendered ligneous, by the motion of the tree, during the descent of the tree (or proper) sap. It is also sufficiently known, that the solid texture of the wood greatly depends upon the quantity of sap which must necessarily descend, and also on the slowness of the descent. Now, both these requisites are materially increased by side-branches, which retain a large quantity of sap, and, by their junction with the stem, occasion a contraction and twisted direction of the vessels, which obstructs the progress of the (proper) sap. Of maple and birch, those trees which have fewest side-branches bleed more freely than the other, but during a much shorter space of time. These hints, therefore, afford additional evidence against pruning, and particularly against pruning fir trees, which, as Mr Knight justly observes, have larger vessels than the others, and therefore, when in an improved soil and climate, side-branches for the purposes above mentioned are essentially necessary to them, if solid, resinous, and durable timber be the object in view.

"From the foregoing remarks, I think the following conclusions may be drawn.

"First, That trees should be planted as much as possible in soils, situations, and climates, *analogous to those of their natural state;* and that it is chiefly in this state, or when there are some defects relative to it, that pruning or culture can be exercised with advantage.

"Secondly, That in proportion to the superiority of the soil, &c. in which trees are placed, over the natural soil of these trees, in the same proportion pruning and cultivating the soil ought to be avoided, and thinning encouraged.

"Thirdly, That particular regard should be had to the soil and situation, where either larches, or any other of the pine tribe, are planted, to remain as the final crop. For as the roots of these chiefly run along the surface, and as in them the great current of the sap is chiefly confined to one channel, that is the trunk, consequently that tribe of trees is peculiarly liable to injury and change, when subjected to unnatural agency.

"Fourthly, That the only way in which oak timber of safe quality can be provided for the British navy, is by enclosing, preserving from cattle, and properly managing, those royal forests where oak is the natural produce of the soil. (Alas! there is reason to fear, that on some future day the neglect of this advice will be regretted). Park oak is very frequently much inferior to *forest oak* in durability."

We differ from the author of the Encyclopædia of Gardening here, even *in limine*, in his assumption, that pruning is of a corresponding nature with culture, in increasing the annual circles of the wood *. Culture, if judiciously executed, increases these annual circles; but common pruning up (which, from the general bearing of the language, we suppose is meant), nine times out of ten diminishes them, and merely tends to extend the stem in length, by throwing all the new formation of branches to the top of the tree, in place of partly to the sides. Thence the tree acquires a slenderer figure, and more delicate constitution; and from greater height, and being without cover of side-branches, loses more by evaporation, and receives less moisture from the ground, which is dried by the breeze passing along under the branches; the principal process of vegetation, assimilation by the leaves, being reduced by the pruning, and carried on at an unnatural height, in a colder less genial atmosphere, under a diminished supply of nourishment from the ground, is consequently less productive of new assimilized

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* The preliminary sentence is very vaguely worded; we suppose, "increasing the annual circles," means increasing them in thickness, not general contents of length multiplied by thickness. But even in the latter sense, we hold pruning tends generally to diminish the annual circles.

matter; and this smaller quantity requiring to be extended along a greater length of stem, the annual rings are necessarily thinner.

We admit that a tree becomes more *stemmy* by being repeatedly pruned up;—we admit, that, on removal of the lower branches, the upper part of the stem may have, for a few seasons, larger annual circles; but the annual circles will be diminished in thickness in a much greater proportion on the lower part of the stem;—we admit, that the timber, from being deposited in a clean lengthened cylinder, becomes far more useful, there being less redundant matter than when scattered out into *stemmy* branches, to which disposition, trees in open situation sometimes incline, especially if not transplanted very young, but to which they are nevertheless much more disposed under the common mode of pruning in an early stage of their growth, than when left to themselves; —we admit, that trees, by pruning, raised to lengthened stem, and thence performing less assimilation, partly compensate for this less assimilation, for some time, by making more stem deposit in proportion to the other deposit, which extends the parts more immediately necessary to new formation,—of the roots and twigs; but the deficiency of productory parts soon reacts to diminish the amount of *all* the new products. In tall trees, this greater deposition on the stem, in proportion to that on the roots, twigs, and leaves, some will think instinctive; some will refer it to an effort of nature to supply the necessary strength to enable the stem to resist the great strain of the winds upon the elevated top. If it take place to a greater extent than what arises from the greater elongation of the necessary vessels of communication, perhaps it is owing to the evaporation or stagnation of the sap on the tall exposed stem, and to the considerable motion or waving of the stem by wind promoting deposition, evincing one of the deep balancings of material cause and effect, or circumstantial regulation, which mocks the wisdom of the wise. We admit, also, that pruning, in the first place, impedes formation of flower-buds, and will sometimes thus prevent exhaustion of trees by seeding, which is so prejudicial both to the quality and quantity of the new wood deposit; but the consequent greater length of stem, greater exposure to evaporation, constriction of bark, and slenderer connecting tubes between leaf and roots, all tend subsequently to promote formation of flower-buds, although the removal of the lower branches may for a few seasons serve to prevent this. We therefore consider pruning, excepting in a very slight degree, to guide to one leader, and to remove the sickly, lower, moss-covered branches a few seasons earlier than they would have dropped off in the common course of decay, to be generally preventive of quantity of wood-deposit, even of common marketable timber, in any considerable number of years, although pruning to a greater degree is often necessary where fine clean timber is required.

Our author's next implied assumption, that a tree produces best timber in a soil and climate *natural* to it (we suppose by this is meant the soil and climate where the kind of tree is naturally found growing), is, we think, at least exceedingly hypothetical; and, judging from our facts, incorrect. The natural soil and climate of a tree, is often very far from being the soil and climate most suited to its growth, *and is only the situation where it has greater power of occupancy, than any other plant whose germ is present.* The pines do not cover the pine barrens of America, because they prefer such soil, or grow most luxuriant in such soil; they would thrive much better, that is, grow faster, in the natural allotment of the oak and the walnut, *and also mature to a better wood in this deeper richer soil.* But the oak and the walnut banish them to inferior soil from greater power of occupancy in good soil, as the pines, in their turn, banish other plants from inferior sands —some to still more sterile location, by the same means of greater powers of occupancy in these sands. One cause considerably affecting the natural location of certain kinds of plants is, that only certain soils are suited to the preservation of certain seeds, throughout the winter or wet season. Thus many plants, different from those which naturally occupy the soil, would feel themselves at home, and would beat off intruders, were they once seated. We have had indubitable proof in this country, that *Scots fir, grown upon good deep loam, and strong till* (what our author would call the natural soil of the oak), *is of much better quality, and more resinous, than fir grown on poor sand* (what he would call the natural soil of the Scots fir), although of more rapid growth on the loam than on the sand; and the best Scots fir we have ever seen, of equal age and quickness of growth, is growing upon Carse land (clayey alluvium).

The reason that Scots fir is of better quality, and more resinous, on good loam and moist till, than on poor siliceous ground, may probably be, that the loam contains more oleaginous matter, and other vegetable products which bear a near relation to resinous, and which, transmitted upwards from the roots, may occasion richer assimilated juices. Men fed upon whale or seal blubber, if the digestion is good, have much fatty deposit upon the body, and the perspired fluid is oil. It is a fact well known to every intelligent farmer, that *infield* or *croft* land, that is land, which, having been earliest cultivated, was, of course, the best soil at first, and which has also been long highly manured at the cost of the *outfield*, and therefore containing much oleaginous and other matter, products of organization, produces grasses and other vegetables much more nutritive to cattle than the *outfield*, even though these vegetables be of the same species, and by reason of more careful culture of those of the *outfield*, also of the same size of plant. We have also considered that light, poor sandy soil, which throws up a considerable flush of vegetation in the spring, partly because it has then sufficient moisture, but which almost entirely gives over producing throughout the latter part of the summer, partly because the winter's moisture is exhausted, may throw out the frame or skeleton of a considerable growth, or annual layer of wood, in the early part of the season, but may not afford sufficient matter for the filling up or maturing the layer into good dense timber later in the season, when the assimilated fluid or sap is believed to descend.

Our author states, that the timber of pruned trees must be inferior to that of trees with many side-branches, because the consequent contracting and twisting of the vessels as they pass the junction of the branches and stem, obstruct the descent of the sap, thence the timber is better matured, and in firs has more of resinous deposit. We admit that the resinous deposition is more abundant in knots and in some of the parts adjacent; but the timber is not better throughout. Worm-eating may be observed to commence generally in the neighbourhood of knots. Although one part of the wood, in consequence of the obstruction of the knot, be more dense and resinous, another part, immediately above or below the knot, where the growths are extended to fill up the vacant space, where the worming commences, is less dense, and of inferior durability, and corruption begun, extends. The knotted timber, of course, is very inferior in strength and value to the clean. We would refer the longer continued flow of sap from maple and birches, which have many side-branches, in part, to the lower or side-branches commencing to vegetate sooner in the spring than the top of the tree; this successive commencement of vegetation prolonging the bleeding.

Again, in larch, we find that by far the hardest and most durable wood is grown upon poor, hard, thin tills (that is, thin of vegetable mould upon the diluvium), even where the root-rot commences about thirty years of age. Now, we ask, is this the natural soil of larches? We have not, however, found larch from rich loam, of better quality than from poor sand, as we have observed in Scots fir. We also consider larch, grown on a proper larch soil—on sound soil and subsoil, or sound rock, common in acclivous situation—superior in quality to larch of equal quickness of growth, raised on rich loam or sand, though not equal to larch of slow growth from the above mentioned poor tills.

We would ask how our author is enabled to assume, as an axiom, that trees produce the best timber in their natural locality? We would also desire some *rational* information to shew in what manner pruning up can in any way conduce generally, to the increase of the timber, or to the enlargement of one-stemmed vegetables. A tree naturally rises in one stem. It throws out its branches in the disposition most favourable to draw the fullest benefit from the light and air. It of its own accord (that is when man does not meddle), gradually raises its pyramidal centre, with proportional lateral spread, as high as is befitting, for the fullest expansion of the individual, under the circumstances of its location. Man may mar this beautiful natural balance easier than decypher the proximate cause he may throw the new deposit of wood in greater proportion upon the upper part of the stem, rendering his beam more suitable from equality of thickness, and particularly in pines, of cleaner, smaller growthed, more durable timber, thence more valuable. But the tree will neither produce the same quantity of measurable timber in a considerable number of years, nor will it ultimately reach to nearly the same size, nor continue life nearly so long, as when left to itself. Man's interference is useful in removing competitors, in giving it lateral room for extension, in *training* it skilfully to one leader and subordinate equality of feeders, should transplanting, early pruning up, or other cause, destroy the natural regular pyramidal disposition—not in pruning it up, thus reducing it to narrower compass, and destroying its balance to the locality.

The use of the infinite seedling varieties in the families of plants, even in those in a state of nature, differing in luxuriance of growth and local adaptation, seems to be to give one individual (the strongest best circumstance-suited) superiority over others of its kind around,. that it may, by overtopping and smothering them, procure room for full extension, and thus affording, at the same time, a continual selection of the strongest, best circumstance-suited, for reproduction. Man's interference, by preventing this natural process of selection among plants, independent of the wider range of circumstances to which he introduces them, has increased the difference in varieties, particularly in the more domesticated kinds; and even in man himself, the greater uniformity, and more general vigour among savage tribes, is referrible to nearly similar selecting law—the weaker individual sinking under the ill treatment of the stronger, or under the common hardship.

As our author's premises thus appear neither self-evident, nor supported by facts, it might seem unfair, at least it would be superfluous, to proceed to the consideration of his conclusions and corollaries.

VII. Cruickshank's Practical Planter.

After the preceding parts of this volume had gone to press, we received a copy of Cruickshank's Practical Planter. We endeavour to give a short view of the contents.

The author commences with some general remarks on the expediency and profit of laying uncultivated ground under timber, stating, rather too strongly, the very superior income derivable from forest than from heathy moors, and its advantages to the soil. No doubt, a great portion of the higher and more rocky part of Scotland is susceptible of little other improvement than planting; and, under timber, would produce more than ten times the income that it does in pasture; and the patriotic motive of embellishing his country, and enriching his countrymen, may excuse his having drawn the advantages of planting in rather high colours. Mr Cruickshank's statement (as he says, designedly kept rather below the truth), that an acre of moor, of average quality, covered with Scotch fir, sixty years planted, would contain 600 trees, value 10s. each, differs considerably from what has come within our experience. The timber of an acre of Scotch fir, sixty years planted in such waste ground as occurs in the valley of the Tay, will not average much more than one hundred pounds per acre on the spot, and laid down on the quay at Newcastle (the place to which the greater part of the Scotch fir on the east of Scotland is carried), would not produce L. 300 per acre.

In order the more to encourage planting, Mr Cruickshank runs into a speculative statement of the fertilizing influence of planting upon the soil, in rather a novel manner, leaving out the particular facts, which, he says, had come under his own observation, and adducing one as proof, furnished to him by another person unnamed. We have often had occasion to see ground, which had produced a crop of firs, brought under tillage without any marked fertility beyond the adjacent fields which had been under proper rotation of cropping, certainly inferior to what had lain for the same length of time in natural grass pasture. There is a particular instance in a slight rising ground (diluvial soil) in the Carse of Gowrie, where the fields, since the rooting out of the fir-wood, have not paid seed and labour in corn, though under regular manuring and rotation. There are even varieties of pine, such as the loblolly, which are known to have an influence upon the soil where they grow poisonous to succeeding crops. Mr Cruickshank himself adverts several times to ground which had produced a crop of timber, being *boss* (hollow) from the roots remaining in the soil, and owing to this hollowness being unsuited for replanting till the roots were removed or consumed. We do not very well comprehend this hollowness, and ascribe the unsuitableness for replanting immediately, rather to exhaustion, or to the formation of something inimical to vegetation, than to any hollowness or manner of arrangement of the soil.

As the causes which promote or retard the formation, or which tend to dissipate the earth's covering of vegetable mould—a covering, on the richness or thickness of which the fertility of ground, as well for most kinds of naval timber as for other products, is so much dependent, though of the greatest importance—have never, that we are aware of, been generally brought into view, we shall devote some space to their consideration.

In the first place, to give a fair specimen of our author, we shall transcribe several pages where he has treated this subject with some ingenuity, and on which he appears to have bestowed considerable care.

Those who have never had an opportunity of seeing old woodlands brought into cultivation, will scarce credit what has now been advanced, that the soil should be enriched by the production of wood, when the experience of ages has proved that it is always exhausted by other crops.—Trees draw their nourishment from a much greater depth than any of the grasses, roots, or different kinds of grain raised by the agriculturist. Most of the latter derive the whole of their subsistence from the part of the soil that lies within a few inches of the surface; but the former, from the superior strength and magnitude of their roots, are enabled to penetrate much farther, and extract food from the very rock which forms the substratum of a great portion, both of our cultivated and uncultivated grounds. This, though it does not account for lands being positively enriched by wood, makes it, at the same time, far less surprizing that trees should grow to a large size, and yet not exhaust the upper part of the soil in so great a degree as most of the crops cultivated by the farmer.

" There is another circumstance which gives ground in wood a great advantage over that in tillage, which is, that the leaves of the trees are suffered to decay and rot where they fall, and, by this means, an annual addition is made to the depth of the vegetable mould. Now, the leaves of a tree may be considered as bearing the same proportion to the trunk and branches, in respect to the nourishment which they require, as the straw of corn bears to the grain. But the manure which cultivated land receives, is, in general, little more than the straw which grows on it after it has served for food or litter to cattle. Ground in wood, then, actually receives, in the annual fall of the leaves, as much enrichment as the farmer bestows on his land under tillage.

"Ground employed in agriculture is exposed at almost every season of the year to the full action of the atmosphere; and in the drought and heat of summer, much of its strength is evaporated. In land covered with wood, the case is entirely different, as from the shade afforded by the leaves and branches, very little evaporation takes place. This, then, is another reason that serves in some measure, at least, to explain the seemingly paradoxical fact in question. For, that evaporation has a very powerful tendency to exhaust land, by drawing off and dissipating the more volatile part of the matter which assists in the process of vegetation, there can be no doubt, when we consider that any kind of dung may be deprived of the greater part of its strength by being long exposed to a dry atmosphere. Nor is it merely by preserving its own original substance that land in wood has the advantage of cultivated ground. Whatever is extracted from the latter in the form of vapour, falls again, when condensed, in the shape of rain or dew; but, instead of descending wholly on the same spots from whence it rose, it is, of course, diffused over the whole space which the clouds, containing it, may happen to cover, and woods and moors have as good a chance of receiving it on its return to the earth, as the ground in tillage. The part of it which falls, either on the cultivated fields or the naked wastes, may be again evaporated before it has time to be productive of any benefit; but the portion of it which the woodlands imbibe is retained to enrich the soil; for, the umbrage excluding the rays of the sun, there is no possibility of its being extracted a second time. Land covered with trees, therefore, while it never loses any thing, receives, with every fall of rain, or of dew, a tribute from the riches of the cultivated part of the country. The advantage derived from this source is greater than will be credited by those who are not aware how much of the substances proper for vegetable nutriment are exhaled from the land in a gaseous state during the dry season of the year.

"But the principal way in which wood becomes instrumental in enriching land still remains to be noticed. When trees attain a certain size, they attract multitudes of birds, which build their nests and seek shelter among the branches. The dung of these animals is the very richest kind of manure which can be applied to land, and possesses, at least, three times the strength of that commonly used in agriculture. The quantity of it produced during the long series of years which trees require to reach maturity is, especially where large colonies of crows take up their abode, very considerable, and must have a powerful influence in improving and fertilizing the soil.

"I ought not to omit here to mention, among the causes why ground is improved by producing wood —the minuteness into which its particles are divided by the roots and their fibres. On taking up a young tree, or even a gooseberry bush, and shaking the earth from its roots, we find the mould that falls from it as completely reduced to powder, as if it had been passed through a fine sieve. Now, the fact seems undoubted, that land is much increased in fertility by being brought to this state."

"Whether a greater accumulation of vegetable mould or enriching of the soil, would take place under a system of rotation of crops, stirring of the ground, and manuring, or under Nature's own system of management—whether, under forest, or under the rich leafy grasses depastured by cattle, is a question of the greatest intricacy, and only admits of local decision, being dependent upon climate, soil, and circumstance. From our author's statements, it would appear that his mind had only ranged along the surface of the subject. He has not taken into account the quantity of root which herbaceous vegetables annually leave in the ground—in some kinds little inferior in bulk to the portion above ground. We have traced oat and wheat roots running down into clay five and six feet (as deep as those of many kinds of trees), extremely numerous, and fine as human hair. He seems not aware that the bulk of yearly vegetable produce is much increased by culture, alternate cropping, and extraneous manure, such as lime, mixture of earths, sea-ware, bones. He has not considered that the annual dead roots within the soil, and the vegetable and animal manure, and the sward and the stubble ploughed down, conduce much more to enrich and thicken the soil than the tree leaves, blown about by the winds, and nearly dissipated into air, before the residuum fixes as a part of the soil; and also that ploughing is often beneficial to shallow soils, by mixing the thin covering of mould with the pure earth of the subsoil,—the vegetable soil-matter, from consequent deeper cover, and more equable moisture, not losing so much by evaporation, and at the same time being more efficacious as nutriment to the vegetation. He seems unacquainted with the fact, that the matter of wood and tree-leaves, especially of the resinous kinds, and those containing much tannin, if not actually pernicious, have very little fertilizing effect—saw-dust has generally no manuring influence, but turns into peat. He also appears to be ignorant, that some kinds of vegetables draw more from the air and water, and others more from the earth; and, especially, that vegetables in a moist climate, depastured or cut before maturity, exhaust the soil much less than when allowed to seed. In Britain, soils, particularly those of good quality, become richer, and thicken more under pasturage, than under any other common vegetation. This is owing to the manuring of the cattle—to the natural grasses not being what is termed scourging plants, especially when not allowed to seed—to the complete cover of the ground by the leaves—to the quantity of root which dies annually—and to the mould thrown up by the red earth-worm, renovating the surface, and partly covering the moss and decayed leaves and old bulbs. It is a curious fact, that, under pasturage, fertility should increase in Britain and diminish in Australia. An uncropt deep cover of grass appears necessary to shelter the vegetable soil-matter during the arid heat, and even to protect the roots from being burned out, in the latter country. And the manure of cattle, instead of being covered by the luxuriant herbage before it is desiccated, and enriching the soil as in England, is, in New South Wales, under the powerful sun and arid air, quickly reduced to dust and dissipated.

The fertility of soils may also be quickly increased, and the vegetable cover thickened almost to any extent under tillage, by first rearing a quantity of large growing annual vegetables, and when nearly full extended, burying this green vegetable produce in drills, resowing the ground immediately with another fast growing kind, and proceeding thus continuedly.

The influence of birds in enriching forest soil, is exceedingly limited, and is chiefly perceptible, not in continued forest, but in some detached portions or clumps of park trees, which colonies of rooks or other large birds frequent.

Of the natural grass which Mr Cruickshank states succeeds in woods to the original heaths, and which he describes as affording such excellent tender food for cattle, we can only say, that either the woods must have been unprofitably thin, and the trees naked, or that he has completely mistaken the quality of the herbage. The grass of woods is unhealthy food for cattle, and generally not relished, being rendered unpalatable and noxious by the resinous and bitter droppings from the tree leaves, and by the bitter and nauseous juices generated in the soil by the roots of trees, which the herbage roots draw up. In dry soils, there is sometimes an accumulation of whitish substance within the ground, around the roots of trees, which some refer to excrementitious deposit *, but which, we think, is rather the produce of a subterraneous vegetable, of the nature of a fungus or mould. Wherever this has increased to a considerable extent, we believe old forest ground will be found of great fertility.

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* It is a theory of Mr Sheriff, Mungo's Wells, that all plants have excrementitious deposit from the roots, the deposit from one kind affording a good manure to another kind. Thence the advantage of mixed grasses and legumes in pastures, and of the rotation of different kinds of crops.

The friability and minute division of the soil to which Mr Cruickshanks refers, existing around the bulbs of trees, can only be of utility where the soil is too adhesive. Light soil is often injured by being cropped by plants which tend greatly to reduce adhesion—what the farmer styles being *driven*: besides, all luxuriant annual crops render adhesive soils friable; and, remaining for a time under natural grass, gives what is termed a turfiness to soils, which continues for several years, and which renders both adhesive and light soils more productive, preventing the adhesive from sinking down into mortar under cultivation, and the light from losing all adhesion or granular arrangement.

There is, no doubt, a disposition to accumulate vegetable deposit in forests, from the moistness, coolness of the ground, and shade, not tending so much as the sunshine and exposure of open country to dissipate or volatilize the residuum of the decayed leaves and roots. In a lower latitude, beyond the line of peat formation, this will have some influence to increase the depth and richness of the vegetable mould; but, in Scotland, where cold till bottom prevails, more injury will result from forest tending to throw the debri of vegetation into combinations unfavourable to the nourishment of plants (such as peat and compounds in which iron forms a part), than advantage, from the dead vegetable matter not being so much dissipated by aration and exposure to the sun. We have often observed the effect of remaining for a length of time in a state of considerable dryness, dissipating the vegetable part of the soil, in some of the old infield clays, where the crown of the large ridges are raised up a foot or two above the original surface-level. At the crown of the ridge, the vegetable clay mould often only extends down about nine inches from the surface, the subsoil immediately under being nearly void of vegetable matter, and extremely close tenacious clay,—a solid foot of it, though of equal moistness, being nearly double the weight of the same bulk of the vegetable clay mould above it. From this clay, almost purely mineral, being a little above the original surface-level, there can be no doubt, that at one time it consisted of the vegetable surface mould of the country, heaped up by repeated ploughings, and that it has gradually lost the vegetable part. The depth of vegetable soil, near the furrows of the ridges, is generally found to be greater than at the ridge crown.

The same dissipation of vegetable matter takes place when a ditch has been dug in clay ground, and the excavated earth thrown up to form a dike on one side. On removal of the dike, the original surface, which no doubt, at the time the dike was formed, consisted of vegetable clay mould similar to the surface around, is always found to be close, heavy, poor clay, containing little or no carbonaceous or vegetable matter. In this case, from the draining effect of the ditch, the original surface under the dike must have been drier than the subsoil of the crowns of the ridges.

The difference of depth and richness of vegetable mould, may nearly always be referred to existing causes, such as the original surface (diluvium, or decayed rock), being a combination of earths favourable to vegetation; occupying a genial situation; being favourably placed with regard to moisture, that is, less or more moist, according as the original surface has been clayey or sandy, or open or close bottomed; and is in no way connected with those flood torrents to which we owe the diluvium deposits themselves—tills, sand and gravel, in which we have never found any vegetable matter, excepting in the coaly or mineralized state.

Unless in the case of alluvium, or of drift sand, or where surface earth has been rolled down from heights, or been *forced* by man*, soil is seldom found to exceed 6 feet in depth, and that only in warm moist situations, propitious to vegetation. In Scotland we never have seen it exceed 3 or 4 feet in depth where its accumulation had not been aided by the above causes. The most common depth is from 6 inches to 2 feet; but, in many of our sterile districts, the surface hardly deserves the name of mould, containing very little vegetable matter, or that matter being unavailable from the presence of tannin.

It is a well known fact, that summer-fallowing always dissipates a portion of the vegetable matter in the soil, although it may, at the same time, tend to fertility, especially in adhesive soils, and where the climate is not very arid and warm, overbalancing the loss from dissipation by the advantage resulting from aëration and absorption of gases and heat, and the sun's rays; by the mechanical disposition and comminution from being thoroughly dried and then moistened; and, probably, by the formation of salts, stimulative to vegetation; or, as it has been thought, by the resting for a season. In the case of any tannin or inert vegetable matter existing in the soil, the heat and drying will tend to reduce these to a condition suitable for vegetable food. In the West Indies, when a summer fallowing is resorted to in order to get clear of the weeds, the fertility of the ground is considerably lessened, from the evaporation or burning out of the putrescent or carbonaceous matter. Were the fallowing continued for several successive seasons, there is no doubt that the whole matter, which, combined with earth, forms mould, would be dissipated.

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* Vegetable soil is sometimes buried deep under volcanic mud, sand, and ashes, or mixed with the subsoil by earthquakes. In some districts of South America, the country, from being fertile, has been recently reduced to sterility, by the vegetable mould being so much scattered through the subsoil by repeated upheavings and tossings about by earthquakes, as to be out of the reach of plants.

About a century ago, it was the practice, in our neighbourhood (an alluvial clay district), to build up the soil of the fallow division, furrow deep, into thin dikes, or walls, about 5 feet high. This was done in early summer. After being dried and aërated by the summer's drought, the dikes were levelled down in the autumn and sown with wheat. This system was considered so fertilizing as to counterbalance the labour and the loss of a crop.

Our own practice has proven that there is scarcely any manure more effective for one crop, particularly of spring sowing, than the clay of old mud walls of houses, though applied in no larger quantity than is usually given of farm-yard manure, and though the clay appear quite free from vegetable matter. It is improbable that the resting of the clay from production could have any effect to occasion this fertility. We considered it to arise chiefly from a quantity of nitre having been formed in, or deposited about, the walls from their long proximity to animal effluvia and to atmospheric air. The fertilizing effect of the dike system of summer-fallow, and even of the present system, may also depend in part on the formation of nitre, well known to be a powerful manure or stimulant in this country. In dry seasons we have scraped together handfuls of salts, partly nitre, from the exposed surface of clay-banks. Should a considerable part of the fertilizing effect of fallowing arise from the formation of nitre, the application of lime and putrescent manures to fallows, in the early part of summer, will be advantageous, as the presence of both are favourable to the formation of nitre. Of course, the utility of encouraging the formation * of

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* There is a deposition from the atmosphere of saline matter going on at the surface of the earth, either evaporated from the ocean, and falling with the rain and dews, or formed by gaseous combinations—most probably both. In countries where the quantity of rain is insufficient to wash this saline accumulation away into the ocean as fast as it is formed, it increases to such a degree

nitre or other salts, combinations of potassa or of soda, will depend on the climate, whether much or little rain falls, and whether the rain water goes off by evaporation or by drainage. In the case of little rain, or the rain-water being nearly all evaporated, nitre and other salts will accumulate in the soil, so as, from their excess, to be injurious to vegetation; whereas, should much rain fall, or the rain-water be chiefly carried off by drainage, vegetation may languish from deficiency of these salts, there being less deposition of the salts, or the salts as they form being washed away. The same will apply to the graminivorous animals. Sea-salt, perhaps also nitre and other salts, will be serviceable in a moist country, or far from the sea, where the plants and water contain little saline matter, and probably pernicious in a dry climate, where the plants and water generally contain much saline matter.

In the portion of the earth from the Atlantic eastward, through Numidia, Libya, Eygpt, Nubia, Arabia, Persia, as far as the Indus, from the enormous ruins, and other vestiges of dense population, as well as from ancient records, there must have ex-

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as almost to prevent vegetation, only a few of what are termed saline plants appearing. This saline accumulation in warm dry countries, bears considerable analogy to tannin deposit in cold coutnries.

isted a considerable depth of vegetable mould covering, where now little is left but pure sand, baked clay, bare rock, and saline encrustations. From the footing which an industrious and brave nation has recently so honourably acquired in this territory, may we not hope that the tide of arid sterility, dissipating the vegetable covering, will be turned, and that through European enterprize and mechanical science, by means of steam and wind power, a system of irrigation will be introduced which will reanimate this dead portion of the earth—spreading forth again perpetual spring, strewing the desert all over with herbs, and fruits, and flowers, converting the sirocco into a breeze loaded with fragrance, and reproducing, in profusion, all the delights of the gardens of Hesperus? From the carbonaceous or soil-matter being burned out, and from the quantity of saline deposit, a very considerable time will, however, elapse before production be generally extended, and the desert so far circumscribed, and the ground cooled so much, as to condense a sufficiency of rain and dew, that a new vegetable mould cover may be formed.

But to return from our wide excursion, we observe, that Mr Cruickshank states, page 25, "that any land that is proper for Scots fir will be found to answer well with the larch." This observation, with what he says of larch "being heavier in proportion to its bulk" than Scots fir, and that "spruce is very easily wrought, and tries the carpenter's tools less than any other kind of wood used in building," would lead us to suspect that our author has had a very limited acquaintance with his subject. A number of different soils will produce large Scots fir where larches will be generally rotted and hollow in the heart, by twenty years of age *. This ignorance of our author is the more glaring, as it is coupled with

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* The matured timber of the larch, in some cases, remains for a considerable time stained before the rot proceeds rapidly; in other cases, the rot makes quick progress; in this rapid decomposition, certain kinds of fungi assist greatly. When once seated, they seem to form a putrid atmosphere or tainted circle around them, either by their living exhalations, or corrupt emanations when dead, which is poisonous to the less vital parts of superior life, and also expedites the commencement of decay in sound dead organic matter, such as timber, thus furthering the decomposition so far as to render it suitable food for their foul appetite, and paving the way to their further progress.

How their seeds enter into the heart of a growing tree having no external rottenness, is not very obvious, unless they are inhaled or imbibed by the root tendrils: from the resemblance which the growth of some of them has to fermentation, it is not even very improbable that the animalcules of supposed molecular or inferior life, have, of themselves, a disposition to unite into some of these aggregates without the presence of any disposing germ.

The modifications of material attractions, by the varied germs of superior life—the fixity of some of these deposites after life is gone —the resolution of these into inferior animalcular, or even molecusome severe strictures on planters in general for *their ignorance* of the proper location of trees. He says, "Scots fir, on soils of a fertile character, is short lived, and the excellence of its timber is in proportion to the slowness of its growth." This is erroneous. We would rather say it is short-lived in bad soil: Memel fir (Pinus sylvestris), is of very superior quality, very large growthed, and of great age. He also asserts "elm prefers a strong clay soil, and it is perhaps impossible to bring this tree to the utmost size it is capable of attaining in land of a different quality." This is also erroneous. We have seen very beautiful large Scots elms grubbed out from a soil of pure gravel, and we can show thousands of instances where Scots elms do not thrive well in clay—in rich as well as poor clay. We are aware that in every volume treating of numerous facts, such as Mr Cruickshank's, many inaccuracies may always be picked out, but the above are rather too prominent.

Mr Cruickshank censures the practice of covering fir seeds one-half inch deep in England, referring the

lar, life—and the instrumentality of zoophytes of the lower order of organization, in hastening this decomposition by the balancing of the attractions of this secondary life, afford a wide field for investigation. Those uncouth sportings of nature quickly appear and disappear as *material* spectres, feeding on corruption, and mocking at primary life.

demand there for Scots plants to the seeds being thus buried in place of being sown, and states that they should only be covered one-fourth of an inch, as is the practice in Aberdeenshire. He also reprehends the author of the Encyclopædia of Gardening, on account of some directions which this author has given, to form, by forcing, a fine friable soil, suitable for the delicate seeds of trees, where this does not previously exist. Now, we should consider that the difference of climate between the neighbourhood of London and Aberdeen would require a difference of cover nearly equal to this; and that forcing a friable earth for seed-beds was absolutely necessary, in the very adhesive clays around London, and so general in the more recent formations of the south and middle of England, although superfluous in the north of Scotland, where sandy or light soil is sufficiently abundant. Seeds, under a moist cloudy atmosphere, will vegetate without cover at all; but in situations where the air is arid in spring, with much sunshine, a covering of some depth is necessary, and that covering, where the rudiments of the plant spring out weak and delicate, is required to be soft and friable, a good absorber and retainer of moisture, and not disposed to run together with rain, or crack with drought.

Mr Cruickshank gives an account of our different forest trees, neither very accurate nor interesting, but, luckily, not very tedious. He then proceeds to treat of nursery, sowing, transplanting, and choosing of plants, where many sensible, though some of them common-place, observations occur, of much use to the generality of planters. His views, however, of the proper manner of planting seedlings in the nursery, are defective. The best method of planting these—neither by laying, nor by dibbling—is first to stretch the line and make a furrow, level in the bottom, as broad as the roots may stretch, with the inner side straight and steep. One person then holds the plant erect in its berth, from two to four inches from the perpendicular side, according to the general size of the horizontal roots, so that the fibres may be regularly spread; and another person throws on the earth from the place of the next furrow; the placer of the plants footing the earth to the roots as he proceeds, or after the row is completed.

The following observations of Mr Cruickshank are worthy the attention of planters:

"Proprietors should not attempt to raise seedlings, but purchase them from professional nurserymen, and place them in a succession nursery of their own. A proprietor may, in general, purchase seedlings much cheaper than he can raise them; while the case is just the reverse with regard to plants of a greater age. In raising seedlings, much skill and attention is requisite, which the professional man can always command at a much more reasonable rate than the proprietor. In the treatment of plants after they are removed from the seed-bed, the rent of the ground is the chief source of expense, as any common gardener will be able to manage them.”

“A general, and a very gross error, in purchasing plants, is to consider those as best which are the largest in proportion to their age. This absurd principle of selection makes those nurseries most frequented by customers which least deserve to be so, such, namely, as are situated in the richest soils, surrounded by the closest shelter, and stimulated by the greatest quantities of manure. It is necessary, no doubt, that plants should be of a size to suit them to the situations for which they are intended; but if they have attained this size sooner than the due time by being forced, they are in the worst state imaginable for growing in a barren moor, or on the bleak side of a mountain.”

“Plants are often much injured, though raised sufficiently hardy in other respects, by being too much crowded in the nursery line.”—“The surest method that I know of enabling those who have little experience, to ascertain whether plants, in the seed-bed, are too much crowded or not, is to compare such as grow on the verge of the alley with those in the interior. If the girt of the latter be equal, or nearly so, to that of the former, the plants have sufficient room."—"When plants have stood for several years in nursery lines, if they are too much crowded, many of their lower branches will be sickly or withered, or the stems will be entirely devoid of branches, excepting within a few inches of the top. This is a mark so plain that no one can mistake.

"Care should be taken not to purchase plants which betray symptoms of disease. When larches not more than three years old cast the whole, or even the greater part, of their leaves, just when the winter commences, it is a sure sign that they are in an unhealthy state, and that many of them will die in the course of next season; for, under this age, the larch should retain a considerable quantity of its old leaves till spring."—"There is also a minute white insect, which is fatal to the larch in plantations, that sometimes attacks it in the nursery after it enters its second year; on this account, it is proper to examine the larch plants the summer previous to purchasing them."—"Scots fir may be regarded as sickly, when the points of the leaves become withered, or when they change their naturally dark colours into a faint yellowish green. Any vestige of withering on the spruce or silver fir, is a sure prognostication of approaching decay. Any kind of fir which has lost its leader may be considered useless.

"When plants are packed up in mats for the conveniency of carriage, strict orders should be given that those which carry their leaves in winter be taken up when they are entirely free from moisture. If they be pulled wet, they will heat and get mouldy in the packages. In the course of a few days good plants are often spoiled in this manner."

Mr Cruickshank does not swerve from the common foolish system, of inculcating a determinate character of soil as generally necessary for each kind of tree. We are angry with the dulness of the writers on location of timber; they will not comprehend that a tree has two ends, by both of which it draws moisture, though from different elements, earth and air. The dullest clown is sensible he requires to drink more under an arid sun than under a drizzling rain. The same holds of trees; if there be little evaporation of moisture from the leaves, and if the leaves, instead of exhaling, can frequently even imbibe water, from the plant occupying an elevated situation, where the air the greater part of the season is cool, and nearly surcharged with moisture, the most porous, driest soil (sufficiently damp in such a situation), will generally be the most suitable; and trees of every kind will prosper in sands, in which, under a dry atmosphere, they would not have survived one summer; whereas in arid, warm, low country, the deepest, dampest loams and clays are generally the best suited for timber, provided water does not stagnate. And, besides, we have found varieties of the same kind or species of tree, *some of them adapted to prosper in dry air and soil, and others in moist air and soil.* Although the above causes prevent a positive limitation of certain kinds of trees to certain soils, yet there are some which have superior adaptation to moist soils and others to dry; some whose roots, from their fibrous soft character, can only spread luxuriantly on light, soft, or mossy soils, and others, whose roots have power to permeate the stiffest and most obdurate. The above explanations will account for much of the incongruity which we find in authors regarding the adaptation of certain kinds of timber to certain soils.

In describing the soils suitable for different kinds of trees, Mr Cruickshank mentions, that "the Scots fir will thrive in very barren situations, provided the soil be dry. Dryness is, in fact, the most indispensable requisite in order to produce a good crop of Scots fir, and it is never advisable to plant this tree in very moist ground, or where draining is necessary to carry off the surface water."—"Stiff land seems decidedly hostile to its growth."—"On a deep rich soil it grows very fast, attains a large size, and soon decays. In these circumstances, its wood is spongy, and of inferior value."—"The most important precept that can be delivered with regard to this tree, is never to plant it either in *wet* or *very stiff* land."

"The larch is also a very hardy plant, and is sure to thrive on any land that will answer for the Scots fir. It is, however, less delicate in its choice of soil than the latter, and will grow in a much greater degree of moisture."—"This tree is one of the surest growers we have in barren soils."

"The spruce is as partial to moist land as the Scots fir is to dry; and in this particular these two species stand directly opposed to one another."—"Spruce may indeed appear to thrive in a dry situation for a few years; but by the time it reaches ten or twelve feet in height, its lower branches will decay, and after that period it will make little progress, but remain even a cumberer of the soil."—"Spruce seems to be most partial to a cold stiff clay: it is, however, a very hardy plant, and not very nice in its choice of soil, provided it have enough of sap."—" I do not mean such as is deluged in winter with stagnant water. This is incompatible with the growth of wood of every kind."—" The silver fir and balm of Gilead will answer in the same kinds of land as the spruce."—" They, together with the spruce, are invaluable for where the soil is deep peat-moss, as neither the Scots fir nor the larch will thrive in it."

There is in the above quotations, in common with many of our opinions (formed hastily upon a too partial acquaintance with facts), a considerable proportion both of truth and error. Such sweeping assertions will, however, generally command the assent and admiration of the reader. From the enjoyment the mind has in forming clear conceptions and reaching conclusions, from its love of order, and from its disposition to cling to every thing like definite, unfluctuating arrangement, to assist its limited powers of comprehension, we are led away by the author, who reduces the character of natural phenomena to great simplicity, although in reality exceedingly complicated.

Scots fir, it is true, has rather a superior adaptation to dry, sharp, and rocky soils; yet there are many situations of poor wet till and clay, and even peat-moss ground, where it will be advantageous to plant Scots fir in preference to any other kind of timber; for this plain reason, that no other kind will thrive so well in those cold moist moors. Both Larix and Abies have a much narrower range of adaptation than Pinus sylvestris. Larch will not thrive in the dead sand nor till flats of the low country, often not in the dead sand and till of rising grounds, in both of which the Scots fir, if allowed sufficient room for side branching, will reach good-sized timber. There is a considerable formation of peat-moss near Dunmore, in which the Scots fir has shown superior adaptation to the Norway spruce. We have also seen, in the moss of Balgowan, Perthshire, fine thriving Scots firs, many of them two feet in diameter, growing in very moist, rich, mossy loam,—so moist, that although in a rather protected situation, a number of the trees, while young, had been laid on their sides by the wind, and were growing luxuriantly in the form of a quadrant of a circle, with as much as six and eight feet of the stem upon the level ground, affording a curve sufficient to reach from the keel of a vessel to the deck at midships. We examined the timber of several of these, and found it superior to the average of home P. sylvestris. The superior quality of the timber may be ascribed to the richness and moisture of the soil, and to the full branching of the trees from their rather open arrangement. There is nothing which conduces so much to the good quality of Scots fir as exposure. Under the great shelter of the close *planted* woods, the timber is soft and porous, without much resin; but under great exposure, especially to dry air, the timber is hard, close, and resinous. This is, however, considerably modified by the soil.

The quality of natural grown timber is considered superior to the planted. Is this occasioned by the former having generally more branches and leaves in proportion to the length of the stem, and being more exposed than the latter? Can root fracture at transplanting, or the kiln-drying of the cones, have any influence to diminish the strength of the fibre or quantity of resinous deposit? We have been told by several old people, in the neighbourhood of Dunsinane, that Scots fir plants, brought more than half a century ago from Mar Forest to Dunsinane Wood, succeeded much better than some which had been procured from nurseries, and also produced better timber.

Clay is assuredly *not* the proper soil for spruce and silver fir; their exceedingly numerous, soft, fibrous, moss-like rootlets, require an easy damp soil.

We have tried a number of kinds of abies, in both dry and moist clay, and have found they did not grow so luxuriantly (thrive so well) as Scots fir or larch. The silver fir shewed superior adaptation to any of the other kinds of abies.

Almost in every instance where we have seen the silver fir and Norway spruce (by far the best spruce for Scotland) growing together, the former was the superior. The timber, in the lower part of the stem, is harder than that of the spruce, but freer and more porous in the upper part. It is probable that the silver fir will not thrive in so elevated or so moist a situation as the spruce, but in all favourable soils it merits a preference.

We now come to a very important part of our author's volume—an account of the most economical, and, as he says, the most successful, mode of planting moors and bleak exposed mountains, but which is brought forward by him under no limitation to place. To the invention of this method, our author lays no claim; he merely describes the practice in a clear and judicious manner.

"The most proper time for removing firs from the nursery to waste land, is when they are two years old."—"The experience I have had enables me to say, with as much confidence as I can speak on any point whatever, that the longer any fir is allowed to remain in the nursery after it has attained two years' growth, so much the less chance is there of its success when removed to its final destination." —" At this period (two years' growth) larches may be obtained transplanted, as it is customary to put considerable numbers of them out into nursery-lines when they are one year old. Such plants have better roots than those that have remained in the seed-bed till they are of the same age; but as their price is considerably higher than that of the latter, it is somewhat doubtful whether they are so much superior in quality as to compensate for the greater expense. At all events, healthy larches from the seed-bed have never failed to give satisfaction when properly planted in soil suitable for them. Other species of fir are scarce ever transplanted in the nursery till they are two years old, so of this age there is no choice left but to take them from the seed-bed."—" Birch, alder, and mountain ash, succeed well when removed from the nursery in their second year."—" Beech and plane do not succeed well unless they have stood some time (two years at least) in nursery lines, after having been removed from the seed-bed."

" The pitting system of planting should be adopted in every instance in which the plants exceed two years old.

"The expense of planting was much reduced by the introduction, about a century ago, of the notching system. Of this there are two varieties, the oldest of which may be described as follows:—One person makes a notch in the ground, or rather two notches crossing each other, with a common spade, raising the sod by bending down the handle of the instrument, till the notch become wide enough to receive the roots of the plant. An assistant, with a bundle of trees, slips the root of one into the aperture thus made for its reception. The spade is then withdrawn, and the closing of the sod on the root is assisted by a smart blow of the heel of the planter. In this way two persons, well practised in the work, will put into the ground between five hundred and a thousand per day.

"This system was much simplified about fifty years ago, and rendered so expeditious, that it seems in vain to look for its receiving any further improvement. Instead of the spade, an instrument of nearly the same shape, but so small that it can be wrought with one hand as easily as a common garden-dibble, was introduced, and is now known by the name of the Planting-iron. With this, a notch is made in the ground to receive the root; and owing to the portability of the tool, and its occupying but one of the hands, the person that works it requires no assistant, but, carrying a parcel of plants in a wallet before him, he singles out one with his left hand, inserts it in the notch, withdraws the implement, fixes the plant with his heel, and proceeds with as much apparent ease as if he were performing the operation in the soft ground of the nursery. In this way of planting, the workman goes forward in such a line as he can judge of by his eye; and as it is extremely difficult to see the plants after they are put in, especially if the heath is pretty long, he sets up poles in the first line, to enable him to keep the second a due distance from it; and in planting the last mentioned, he removes these poles into it as he comes opposite to them, which then serve as his guide in planting the third; and thus he proceeds till he cover the whole ground. The lines thus formed are necessarily so zig-zag, that when the trees grow up, they do not seem to have been planted in rows.

"In this way, an expert workman will plant between three and four thousand young plants a-day, and do it so perfectly, that the fault will not be his if a single individual of the whole number fail to grow. I have assisted in planting, according to this plan, upwards of three thousand acres in Aberdeenshire; and, in all that extent, I know not of a single instance of failure, where the plants were in a healthy state when put into the ground, of the proper age and varieties, and suitable for the soil.

"To plant well and expeditiously in this way requires considerable dexterity on the part of the workman; and where raw hands are employed, it will be necessary to have some person to teach and superintend them."

Mr Cruickshank disposes of the old system of slit planting by the spade, with very little ceremony; as it would almost seem, without being able to appreciate its merits. It is, in fact, a totally different mode of planting from that by the flat dibble-planter or planting-iron, and is well adapted for all plants with horizontal roots, and which have stood from one to three years in the nursery lines. By first striking the spade in perpendicularly, as deep as the turf-soil, by again striking it in at right angles to the end of the first cut, in the form of a T, and bending back the spade, the turf-soil is raised from a horizontal bed, and the first cut opened so wide as to admit the root, which inserted and drawn a little along by an experienced hand, and well tramped down, has its rootlets disposed over the horizontal bottom almost as regularly and well adjusted for growing, as can be done by pit-planting. This practice is sometimes performed singly, a clever workman managing the spade with one hand and the plants with the other, and inserting 1000 each day. The plants suited for this system are fully double the size of those suited for the flat-dibble system, and are purchased at about one half more price, thus enhancing the cost of planting to £1, 10s. or £2 per acre; but in many situations, especially where the herbage grows freely, affording an earlier growth, and more regular success, sufficient to balance the greater expense ten times over.

Although the cross-system of slitting is the best for commanding general success, yet wherever the flat dibble planting can be depended on, it merits a preference, as from the smallness of the plants, the roots receive less fracture and derangement in the woody state, and the process comes nearer to raising from the seed *in situ*.

The expense of each system per acre, will be nearly as follows:—

By Cross-slitting, or the Double Notch.

3000 larches and Scots firs, from one to three years transplanted, at 5s. - - -	L.0	15	0
500 hard wood do. do. at 12s. -	0	6	0
4 days of one superior planter, or of two ordinary planters, at 3s. - -	0	12	0
	L.1	13	0

By the Flat Dibble, or the Single Notch.

4000 larches or Scots firs, from the seed-bed, or one year transplanted, at 2s. 6d. - -	L.0	10	0
1000 hard-wood plants, - -	0	7	0
1½ day of a planter, at 2s. - -	0	3	0
	L.1	0	0

Although our author speaks so confidently of the success of transplanting out firs at one and two years of age, yet this must only be taken under limitation to the country in which his experience has lain,—the barren mountains and moors of Scotland, where the vegetation of the heaths is extremely slow, and the herbage both thin and short. Were these small plants used in the superior climates of England and Ireland, where the vegetation of the grasses, and other natural occupiers of the soil, is very luxuriant, there would scarcely be one in a hundred that would ever be seen after the first spring, unless a very expensive cultivation to check the weeds were resorted to. To effect economical planting in these soils, it is necessary to have the plants sufficiently large, not too close together, and placed in rows, that a mower may be able to distinguish them among the herbage while he cuts it down; or what is much better, that the spade or plough * culture may be prac-

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* We have raised crops among young trees (as well timber as fruit trees), not four yards apart, by plough culture, and have found the process, after the ploughmen and horses were accustomed to it, not much more expensive than common cultivation, and the crop, till the trees became too close, scarcely inferior. By means of a long *muzzle* to the plough standing out towards the left side, and a driver to the horses beside the ploughman, we succeeded in getting the two first furrows lapped a little over each other in the row of trees, where the gathering of the ridge commenced (we gathered up at every other row). In the row of trees where the finishing of the ploughing of the ridge occurred, we were obliged to leave a stripe of ground about two feet wide, to be dug by the spade. The horses required to be yoked in file, and to drag by ropes (traces) rather than by chains, as the bark of the trees was liable to be rubbed off by the latter. The more to guard against rubbing, we had the *swingletree* constructed so that the trace-ropes came out from a hole in the ends, without any hook. In harrowing the ground, one man is required to lead the horses, and another to direct the harrows. In rich soil, under cultivation of green crop, in this manner, trees progress very rapidly, and from the open arrangement acquire very healthy constitutions. Of course, when

tised, and potatoes, turnips, or other green crop, raised among them, without the plants being overwhelmed. In case of grass production, the oftener during the season the young plantation is mown, the more advantageous, as well that the plants may be the more easily distinguished, as that the lower branches may not be smothered, nor the soil so much exhausted and dried by the blooming and seeding of the herbage; of course, a short scythe is required, and also a very careful mower.

Speaking of the best season for planting, Mr Cruickshank states:—

"In wet and swampy soils, as well as in land, whether dry or moist, whose surface is bare, I would be inclined to prefer the spring. Wet land swells to such a degree, that plants which have not had time to take a firm hold with their roots, are almost

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not coniferæ, the plants require a little more attention to train to one leader and equality of feeders, than when close planted. We should consider plough cultivation of young woods, provided ploughmen as expert and careful as the Scots could be obtained, much more worthy the attention of the English planter than the Withers' system (trenching). Need we mention, that in green crop, every thing depends upon plenty of manure and of well-timed plough and horse hoe labour? Excepting in the case of larch, we should dread no injury to the trees or timber from plenty of manure.

inevitably thrown out."—"These remarks have reference only to the system of planting by notching: when the pitting system is adopted, it fixes the plant so thoroughly, as to render the utmost power of frost incapable of doing them any injury."—"The utmost limits of the planting season may be estimated from the middle of October to the middle of March."—"I am a decided advocate for thick planting, and would advise that no fewer than 3000 trees per acre be planted in good land, nor a less number than 4000 when the soil is of a middling or inferior quality."

Mr Cruickshank must surely have had little acquaintance with soft, spongy, close-bottomed soils, or he would not have asserted that pit-planted trees are not subject to be thrown. If planted in the early part of winter or autumn, trees of the usual size, which have remained from one to three years in the nursery line, are very frequently thrown from such soils. This is caused by the freezing earth first catching fast hold of the plant at the surface, and afterwards swelling underneath from the enlargement of the freezing water in its pores, and from the open crystallized *honeycomb* arrangement which takes place by congelation. As the stem is fast to the ground at the surface, and the earth subsequently enlarged underneath as far as the congelation proceeds, the roots below the congelation must of necessity be drawn upwards to the distance which the ground has swelled after the stem was fixed to the surface. The earth, on thaw, first loses hold of the plant at the surface, and then falls away as it contracts. Each successive frost and thaw during winter thus raises the plant a certain space, till by spring it often is so far extracted, as to fall over on its side. When the plant has stood a season, there is generally a tuft of herbage around its stem, which prevents the freezing in a considerable degree; and the roots having fixed in the lower earth, resist the pulling up so much, that the hold which the frozen earth has of the stem at the surface gives way, sometimes pulling off a portion of the bark, and the earth rises around the stem in place of pulling the tree.

Instead of the season for spring planting being over by the middle of March, we think that, in many of our wet moors, it should then only be commencing, especially under the pitting system. However, planting should never be deferred a day later in spring than what is absolutely necessary to render the ground sufficiently dry for the process.

Mr Cruickshank's opinions regarding pruning and thinning are generally not very incorrect. His commencing sentence on pruning, that "most deciduous trees, if left to themselves, have a tendency to grow with short trunks, containing little timber, and to waste their strength on large unweildy tops," would, however, lead us to form a different conclusion. The very tall, clean, straight, deciduous trees, in the American forests, give a sufficient answer to this. We like his remark respecting thinning, that "it is only efficacious when applied as a preventive, not as a cure."

Mr Cruickshank next brings forward his plan of raising oak forest, which appears to have been his own invention, although invented before. Whenever mice and other gnawers (glires) are not very abundant, it, if properly executed, would seem to be the best method of raising oak forest; and, indeed, in many situations, the only practicable one. Mr Cruickshank's method coincides nearly with Mr Sang's, only he does not carry his system of protection so far as Mr Sang, in first raising belts of the most hardy kinds of timber, distributed to windward of, and intersecting the place intended to be planted, in such a manner as to afford the best possible shelter from the coldest most destructive winds. Mr Cruickshank, who has never carried his plan into execution, except in an experiment embracing a few yards, directs that the ground intended for oak forest should first be planted with Scots fir and larch, about 4000 to the acre, by the single-notch process, previously described, which can be accomplished under L. 1 per acre. As soon as these have risen to four feet in height, he prepares patches about two feet square and ten feet distant in the interstices, by digging the soil over, and mixing a spadeful of slaked lime carefully with the mould, taking out a tree whenever the interstices do not suit for the patches. He then plants, in the end of March or beginning of April, five acorns in each patch, about an inch deep, one in the centre, and the other four in the angles of a foot square, and gives them no farther attention for two years, except removing any overhanging low fir branch. He then goes over the patches, cutting out all the supernumerary plants, a few inches below the surface, leaving the most promising one on each patch, being very careful not to disturb any of its roots in cutting out the others. As these oak plants extend in size, he gradually removes the fir.

Excepting the bare plan itself, which is certainly very plausible, there is nothing in the description of the practice—the preparation of the patches of ground to receive the seed and the subsequent management—which merits attention. His very particular interdiction of the use of manure is, to say the least of it, injudicious—as if it signified to the plant whether it were forced by the use of lime, or by a little putrescent manure, both of which Mr Withers would consider very advantageous; or as if there were much fear on our poor exposed wastes of erring on the side of rendering the plant delicate from over luxuriance; its constitution, on the contrary, would rather be strengthened. Mr Cruickshank, in directing the removal of the fir nurses, one thousand per acre to stand till they have reached twenty-five years, fit for roofing of cottages, and similar purposes; and five hundred till they have reached thirty-five years; his dividing a slaked boll of lime into five hundred spadefuls; and his bestowing no hoeing or weeding upon his seedlings, would show, without his admitting it, that he had never practised this mode of forming plantation.

Prefacing this system of rearing oak forest, Mr Cruickshank in rather a clever manner points out its advantages, and also the disadvantages and consequent failures of *planting* young oak trees in exposed situations. But after all his eulogy, we think he has left something unsaid. The great disadvantage attending transplanting oaks to situations not very favourable to their growth, is, that the plant which, under any circumstances, receives irreparable and often mortal harm, from the severe injuries of removal, has to contend, in this mutilated condition, at the same time with the uninjured occupiers of the soil (the nurses or the native weeds), and with the unpropitious situation; whereas, when the plant springs up from the acorn a native, especially when it is assisted at first by weeding or hoeing, the part above ground being always in proportion to that below, and receiving due nourishment, it contends with the occupiers on more equal terms, and encounters the sterility of the soil, or the severity of the climate, with all its natural powers unimpaired.

As it is the natural condition of the seedling to grow up under the shelter of the parent tree, so also does it happen, that it rises under this shelter with greater luxuriance and vigour than when exposed to the evaporation, and parching sun, and battering wind, of the bare country.

We have admired the beautiful, straight, luxuriant, shoots of the young hollies, thrown out under shelter, and have compared them with the dry stunted shoots of the young holly in the open country, though in the former case their roots had to contend with the roots of larger trees, and in the latter they had the soil to themselves. Experience has proved, that in exposed bleak situations, shelter is necessary to young plants. Transplanted oaks among the roots of young trees, so large as to afford sufficient shelter, very frequently do not succeed, at least without the utmost care in the transplanting, and a considerable deal of labour to prevent the roots of the shelter trees from starving the transplanted ones, unless a very propitious moist summer follow the transplanting. Raising from the seed, which obviates all this, seems therefore the only conveniently practicable way. Yet it must be owned, that the system of raising forests *in situ* from the seed, appears, as yet, much more successful on paper than on our hills and moors.

In endeavouring to confute the opinion, that the oak will not grow throughout Scotland, but in the milder and more propitious situations, Mr Cruickshank adduces the well-known fact, that large oak timber is found in almost every peat-moss.

This is a fact worth tracing to its cause. Under Nature's own conduct, trees advance considerably further into elevated or cold inhospitable regions, than they would otherwise do, by means of the mutual shelter, and of the more hardy kinds acting as an advance guard. Yet there is a limit to this, as the power of ripening seed is not increased by shelter in proportion to the power of growing, perhaps, not at all; we instance the Spanish chestnut, which has scarcely ever been known to ripen seed in Scotland. Seed-grown trees will, therefore, under Nature's arrangement, not be found extending much beyond *the line of seed ripening*. From nuts, acorns, and other seeds, fully developed, being found in elevated mosses in this country, other causes than shelter appear to have existed.

Before this country was so much overrun by men and oxen, a great deal of timber had existed, covering much of the superior land which is now under tillage. This consisted chiefly of the oak, Scots fir, birch, hazel, and alder,—the oak extending northward and to elevations, and ripening seed, and attaining to a size which it does not now do, either wild or cultivated, in the same latitude, neither here nor in any other portion of the world; which, along with some other facts, lead to the supposition, that the climate has changed a little,—in part, possibly, as we have before stated, from the gradual formation of peat, to which, overthrown oak forest, from the abundance of the tannin principle, has a great disposing influence, even under a warmer climate than present Scotland. The highest latitude to which a tree, or any other kind of plant, reproducing by seed, naturally extends, depending on the ripening of the seed, and also on the power of occupancy, is however different from that where it will grow, when ripe seeds are procured from the coldest place where they ripen, and all the competitors removed; and under the system of shelter belts, hardy pine nurses, and seeds from the nearest place where they ripen, we have no doubt that oaks may be extended to a colder situation than Nature herself would have placed them in. For the higher more bleak portion of the country, we would recommend acorns grown in Scotland, in preference to those imported from England. We have several times observed wheat, the seed of which had been imported from England, sustain blight and other injuries in a cold moist autumn, when a portion of the same field, sown of Scots seed, at the same time as the other, and under the very same circumstances, was entirely free from injury. English acorns are also frequently heated in the casks in which they are imported, which must impair their vigour *.

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* We are indebted to our friend Mr Gorrie, Annat Garden, for the fact, that English acorns throw up a much more luxuriant stem than the Scots; they forming a step of several inches when planted next each other in the nursery line. We should consider this to arise from the largeness of the rudiments of the plant, and greater quantity of garnered nourishment in the English acorns,

The part of Mr Cruickshank's volume which we have analyzed, does not extend much beyond the first half: this portion is well worth a perusal. We have merely glanced over the remainder: it is a make-up scarce worth noticing. The language, on the whole, is easy and plain; and although the volume contains a considerable number of errors, in the pointing out of which we have not been sparing, yet will it form an excellent planter's assistant to people who have ground to plant, and are ignorant of the process of planting.

WE have now brought before the reader a pretty fair picture of the Forestry of the present day. Some may wonder that the written science of arboriculture should be so imperfect and inaccurate; but the knowledge of the art, and the power of communicating that knowledge, are of so different a cha-

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which are nearly double the size of the Scots, our present climate being insufficient for the proper development. This leads to the question, will the greater luxuriance balance any tenderness from want of acclimatizing? Would the oak keep its present locality in Scotland if left to nature? A careful inspection of the most elevated peat mosses in which remains of timber exist, and a comparison of the size of the seeds found there, with that of those of the present day, grown the nearest to this in situation, would resolve the question of refrigeration.

racter, it not unfrequently happens, that those write who cannot act, and those who can, are incompetent to write—sometimes unwilling; besides, correct opinions on this subject, as on most others, are only just beginning to be formed. We have endeavoured to assist in disentangling the correct from the erroneous. It is impossible for the most wary always to avoid misconception of facts, but man merits the name of rational only, when he evinces a readiness to break from those misconceptions, to which the narrow-minded, the proud, the vain, and the creature of habit and instinct, cling so obstinately. As a friend, we have stood on no ceremony with our brother arboriculturists. We have laid ourselves open to their criticism, and we hope they will shew as little ceremony with us.

APPENDIX.

APPENDIX.

NOTE A.

It is only on the *Ocean* that *Universal Empire* is practicable—only by means of *Navigation* that all the world can be subdued or retained under one dominion. On land, the greatest numbers, and quantity of materiel, are unavailable, excepting around the spot where they are produced. The most powerful army is crippled by advancing a few degrees in an enemy's territory, unless when aided by some catching enthusiasm; its resources get distant—communication is obstructed—subjection does not extend beyond the range of its guns, and it quickly melts away. The impossibility of dominion extending over a great space, when communication is only by land, has often been proved. The rule of Cyrus, or Alexander, the Cæsars, the Tartar conquerors *, or Bonaparte, did not extend over a tithe of the earth; and we may believe, that, by some of these chiefs, dominion was extended as widely as under land communication could be effected—further than under it could be supported.

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* The very extended sway, the state of civilization considered, of the Tartar, was evidently the consequence of the great facility of communication from the plain open surface of the country, and the equestrian habits of the people.

On the contrary, when a powerful nation has her warlike strength afloat, and possesses naval superiority, independent of being unassailable herself, every spot of the world, wherever a wave can roll, is accessible to her power and under her control. In a very short time she can throw an irresistible force, unexhausted by marches, and with every resource, upon any hostile point, the point of attack being in her own choice, and unknown to the enemy. In case of her dependent dominions being scattered over the two hemispheres, her means of communication, and consequent power of defending these and supporting authority, are more facile than what exists between the seat of government of any ordinary sized continental kingdom and its provinces. Were a popular system of colonial government adopted, many islands and inferior states would find it their interest to become incorporated as part of the Empire.

Note B.

There is a law universal in nature, tending to render every reproductive being the best possibly suited to its condition that its kind, or that organized matter, is susceptible of, which appears intended to model the physical and mental or instinctive powers, to their highest perfection, and to continue them so. This law sustains the lion in his strength, the hare in her swiftness, and the fox in his wiles. As Nature, in all her modifications of life, has a power of increase far beyond what is needed to supply the place of what falls by Time's decay, those individuals who possess not the requisite strength, swiftness, hardihood, or cunning, fall prematurely without reproducing—either a prey to their natural devourers, or sinking under disease, generally induced by want of nourishment, their place being occupied by the more perfect of their own kind, who are pressing on the means of subsistence. The law of entail, necessary to hereditary nobility, is an outrage on this law of nature which she will not pass unavenged—a law which has the most debasing influence upon the energies of a people, and will sooner or later lead to general subversion, more especially when the executive of a country remains for a considerable time efficient, and no effort is needed on the part of the nobility to protect their own, or no war to draw forth or preserve their powers by exertion. It is all very well, when, in stormy times, the baron has every faculty trained to its utmost ability in keeping his proud crest aloft. How far hereditary nobility, under effective government, has operated to retard "the march of intellect," and deteriorate the species in modern Europe, is an interesting and important question. We have seen it play its part in France; we see exhibition of its influence throughout the Iberian peninsula, to the utmost degradation of its victims. It has rendered the Italian peninsula, with its islands, a blank in the political map of Europe. Let the panegyrists of hereditary nobility, primogeniture, and entail, say what these countries might not have been but for the baneful influence of this unnatural custom. It is an eastern proverb, that no king is many removes from a shepherd. Most conquerors and founders of dynasties have followed the plough or the flock. Nobility, to be in the highest perfection, like the finer varieties of fruits, independent of having its vigour excited by regular married alliance with wilder stocks, would require stated complete renovation, by selection anew, from among the purest crab. In some places, this renovation would not be so soon requisite as in others, and, judging from facts, we would instance Britain as perhaps the soil where nobility will continue the longest untainted. As we advance nearer to the equator, renovation becomes sooner necessary, excepting at high elevation—in many places, every third generation, at least with the Caucasian breed, although the finest stocks be regularly imported. This renovation is required as well physically as morally.

It is chiefly in regard to the interval of time between the period of necessary feudal authority, and that when the body of the population having acquired the power of self-government from the spread of knowledge, claim a community of rights, that we have adverted to the use of war. The manufacturer, the merchant, the sailor, the capitalist, whose mind is not corrupted by the indolence induced under the law of entail, are too much occupied to require any stimulant beyond what the game in the wide field of commercial adventure affords. A great change in the circumstances of man is obviously at hand.

In the first step beyond the condition of the wandering savage, while the lower classes from ignorance remained as helpless children, mankind naturally fell into clans under paternal or feudal government; but as children, when grown up to maturity, with the necessity for protection, lose the subordination to parental authority, so the great mass of the present population requiring no guidance from a particular class of feudal lords, will not continue to tolerate any hereditary claims of authority of one portion of the population over their fellow-men; nor any laws to keep up rank and wealth corresponding to this exclusive power.—It would be *wisdom* in the noblesse of Europe to abolish every claim or law which serves to point them out a separate class, and, as quickly as possible, to merge themselves into the mass of the population. It is a law manifest in nature, that when the use of any thing is past, its existence is no longer kept up.

Although the necessity for the existence of feudal lords is past, yet the same does not hold in respect to a hereditary head or King; and the stability of this head of the government will, in no way, be lessened by such a change. In the present state of European society, perhaps no other rule can be so mild and efficient as that of a liberal benevolent monarch, assisted by a popular representative Parliament. The poorest man looks up to his king as his own, with affection and pride, and considers him a protector; while he only regards the antiquated feudal lord with contempt. The influence of a respected hereditary family, as head of a country, is also of great utility in forming a principle of union to the different members, and in giving unity and stability to the government.

In respect to our own great landholders themselves, we would ask, where is there that unnatural parent—that miserable victim of hereditary pride—who does not desire to see his domains equally divided among his own children? The high paid sinecures in church and state will not much longer be a great motive for keeping up a powerful family head, whose influence may burthen their fellow-citizens with the younger branches. Besides, when a portion of land is so large, that the owner cannot have an individual acquaintance and associations with every stream, and bush, and rock, and knoll, the deep enjoyment which the smaller native proprietor would have in the peculiar features, is not called forth, and is lost to man. The abolition of the law of entail and primogeniture, will, in the present state of civilization, not only add to the happiness of the proprietor, heighten morality, and give much greater stability to the social order, but will also give a general stimulus to industry and improvement, increasing the comforts and elevating the condition of the operative class.

In the new state of things which is near at hand, the proprietor and the mercantile class will amalgamise,—employment in useful occupations will not continue to be held in scorn,—the merchant and manufacturer will no longer be barely tolerated to exist, harassed at every turn by imposts and the interference of petty tyrants;—Government, instead of forming an engine of oppression, being simplified and based on morality and justice, will become a cheap and efficient protection to person and property; and the necessary taxation being levied from property alone, every individual will purchase in the cheapest market, and sell the produce of his industry in the dearest. This period might, perhaps, be accelerated throughout Europe, did the merchants and capitalists only know their own strength. Let them, as citizens of the world, hold annual congress in some central place, and deliberate on the interests of man, which is their own, and throw the whole of their influence to support liberal and just governments, and to repress slavery, crime, bigotry—tyranny in all shapes. A Rothschild might earn an unstained fame, as great as yet has been attained by man, by organizing such a power, and presiding at its councils.

NOTE C.

THE influence of long continued impression, constituting instinct or habit of breed, is a curious phenomenon in the animal economy. Our population in the eastern maritime districts of Britain, descended principally from the Scandinavian rover, though devoted for a time to agricultural or mechanical occupation, betake themselves, when opportunity offers, to their old element, the ocean *,

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* The habit of breed is apparent in many places of the world. Where a fine river washes the walls of some of the internal towns of France, scarce a boat is to be seen, except the long tract-boats employed in the

APPENDIX.

more immediately in the tide of the ingress of the Caucasian, where the purest current has latest flowed, and the climate is more suitable, and also in some of the maritime districts, where the air is moister, and to which they have been seaborn at a later period, the Caucasian character is still prominent. Something of this, yet not so general, is occurring in Britain, where the fair bright-blooded race is again giving place to the darker and more sallow. This may, however, be partly occasioned by more of artificial heat and shelter and other consequences of higher civilization. There seems to be something connected with confinement and sedentary life, with morbid action of the liver, or respiratory or transpiratory organs, which tend to this change under dry and hot, and especially confined atmosphere. Perhaps imagination is also a worker here; and the colour most regarded, as snow in cold countries, black among colliers, white among bleachers, or even the dark colour of dress, may produce its peculiar impression, and our much looked-up-to Calvinistic priesthood, from the pulpit, disseminate darkness as well as light.

Our own Kelt has indubitably improved much since, *par necessité*, he took to the mountain; but, though steadily enduring, when there is mental excitement, he has acquired a distaste to dull hopeless unceasing labour, and would fare scantily and lie hard, rather than submit to the monotonous industry of the city operative, or the toil of the agricultural drudge. Though once a fugitive, the Kelt is now, in moral courage and hardihood, equal perhaps to any other, yet he still trembles to put foot on ocean.

Notwithstanding that change of place, simply, may have impression to improve the species, yet is it more to circumstances connected with this change, to which the chief part of the improvement must be referred. In the agitation which accompanies emigration, the ablest in mind and body—the most powerful varieties of the race will be thrown into their natural position as leaders, impressing the stamp of their character on the people at large, and constituting the more reproductive part; while the feebler or more improvident varieties will generally sink under the incidental hardships. When a swarm emigrates from a prosperous hive, it also will generally consist of the more adventurous stirring spirits, who, with the right of conquerors, will appropriate the finest of the indigenæ which they overrun; their choice of these being regulated by personal qualities, not by the adventitious circumstances of wealth or high birth—a regard to which certainly tends to deteriorate the species, and is one of the causes which renders the noblesse of Europe comparatively inferior to the Asiatic, or rather the Christian noblesse to the Mahometan.

It has been remarked, that our finest, most acute population, exist in the neutral ground, where the Caucasian and Keltic have mixed, but this may arise from other causes than admixture. Our healthiest and poorest country borders the Highlands, and the population enjoy more of the open air. Our eastern population, north of the natural division of Flamboroughhead, are also harder and sharper featured, and keener witted, than those southward, who may be styled our fen-breed. There is no doubt more of Keltic blood mingled with the north division; but the sea-born breeds have also been different, those more northerly being Scandinavian, and the more southerly consisting of the native of Lower Germany and the heavy Fleming. The placid-looking Englishman, more under the control of animal enjoyment, though perhaps not so readily acute, excels in the no less valuable qualities of constancy and bodily powers of exertion; and when properly taught under high divisions of labour, becomes a better operative in his particular employment, and even will sometimes extend scientific discovery further, than his more mercurial northern neighbour, who, from his quick wits being generally in advance of his manual practice, seldom attains to the dexterity which results from the combination of continued bodily action and restricted mental application. There exists, however, very considerable intellectual capacity in this English breed, but it too frequently is crushed under the preponderance of the animal part, affording that purest specimen of vulgarity, the English clown. But, independently of climate and breed, a great part of the low Englander's obtuseness is referable to his being entailed lord of the soil, under poor-rate law, contravening a natural law (see note B), so that, when unsuccessful or out of employment, he, without effort to obtain some new means of independent subsistence, sinks into the parish or work-house labourer. On the contrary, the Scotsman, with no resource but in himself, with famine always in the vista, as much in his view as a principle of action in material affairs as his strong perception of the right in moral, and also under the stimulus of a high pride, leaves no means untried at home; and, when fairly starved out of his native country, among various resources, often invades the territory of his more easy-minded southern neighbour, where his acuteness seldom fails to find out a convenient occupation, in which manual dexterity is second to economy and forethought—his success exciting the wonder and envy of the dull-witted native.

It would appear, that the finest portion, at least apparently so, of the north temperate zone, between the parallels of 30° and 48° latitude, when nearly of the level of the ocean, is not so favourable for human existence as the more northern part between 50° and 60°, or even the torrid zone. The native of the north of Europe has a superior development of person, and a much longer reproductory life than the native of the south, which more than counterbalances the earlier maturity of the latter in power of increase. Independent of the great current of population setting south in the northern part of the temperate zone, there seems even to be some tendency to a flux northward, from the confines of the torrid; but this arises rather from the unsteadiness of the seasons, and consequent deficit of food, at particular times, than from a steady increase of population.

Note D, p. 4.

Our milder moods, benevolence, gentleness, contemplation—our refinement in sentiment—our "lovely dreams of peace and joy," have negative weight in the balance of national strength. The rougher excitement of hatred, ambition, pride, patriotism, and the more selfish passions, is necessary to the full and strong development of our active powers. That Britain is leaving the impress of her energy and morality on a considerable portion of the world, is owing to her having first borne fire and sword over these countries: the husbandman tears up the glebe, with all its covering of weeds and flowers, before he commit his good seed to the earth. Life and death—good and evil—pleasure and pain, are the principles of impulse to the scheme or machine of nature, as heat and cold are to the steam-engine, thus moving in necessary alternate dependence. Our moral sense, our perception and love of good, could not exist without the knowledge of evil; yet, we shudder at the truth of evil being part and portion of nature.

Note E.

There cannot be a more striking proof of the necessity of a better representation of the marine interest, than the fact, that our trading vessels are constructed of an unsuitable figure, owing to the improper manner of measuring the register tonnage. In order to save a little trouble of calculation to the surveying officer in gauging the contents of the vessel, the law directs him merely to take the length and breadth at the widest place, and from these lines, by a regular formula, to compute the tonnage; the vessel paying the charges for lights and harbours, and other dues, in proportion to this measurement. The result is, that, in order to lessen these dues individually, our vessels are constructed deep in proportion to breadth, consequently are sluggish sailers, and not nearly so safe and pleasant sea-boats as they otherwise would be—many a ship, especially with light cargo, getting on her beam-ends and foundering, or not standing up under canvass to weather a lee shore. The influence of this absurd measurement law is the more unlucky, as the ship-owner, from a deep vessel being, in proportion to the capacity of the hold, cheaper than one of shallower or longer dimensions, is already more disposed to construct his vessel deeper than is consistent with the safety of the seamen and security of the ship and cargo, the particular insurance of a deep vessel not being greater than that of one of safer proportions. The injurious effect from vessels being constructed on the principles of avoiding tolls or dues, rather than for sailing, will occur to every one. We need not say that all this flows from the ignorance or carelessness of the constructors of our Parliamentary acts, consequent to defective representation.

NOTE F.

IN the case of the upper carse on the Tay Firth, there is evidence, both from its vestiges and from records, that it had occupied, at least, the entire firth, or sea-basin, above Broughty Ferry, and that about 50 square miles of this carse has been carried out into the German Ocean by the strong sea-tide current, a consequence of the lowering of the German Ocean, and of the deepening of the outlet of this sea-basin at Broughty Ferry, apparently by this very rapid sea-tide current. This carse appears to have been a general deposition at the bottom of a lake having only a narrow outlet communicating with the sea, and probably did not rise much higher than the height of the bottom of the outlet at that time.

An increase of deposition of alluvium, or prevention of decrease, may, in many cases, be accomplished by artificial means. The diminution of the carse of the Tay was in rapid progress about sixty years ago, the sea-bank being undermined by the waves of the basin, the clay tumbling down, becoming diffused in the water, and being carried out to sea, by every ebbing tide, purer water returning from the ocean the next tide-flow. This decrease was stopped by the adoption of stone embanking and dikes. A small extension of the carses of present high-water level, in the upper part of the firths of Tay and Forth, has lately been effected, by forming brushwood, stone and mud dikes, to promote the accumulation.

In doing this, the whole art consists in placing obstructions to the current and waves, so that whatever deposition takes place at high-water, or at the beginning of the flood-tide, when the water is nearly still, may not again be raised and carried off.

Notwithstanding this accumulation, and also the prevention of further waste of the superior carse, the deepening of the Tay Firth, formerly carse, and of the gorge at Broughty Ferry, seems still in progress, and could not, without very considerable labour, be prevented. In the case, however, of the sea-basin of Montrose, a little labour, from the narrowness of the gorges, would put it in a condition to become gradually filled with mud. Not a great deal more expenditure than what has sufficed to erect the suspension-bridge over its largest outlet, would have entirely filled up this outlet, and the smaller outlet might have been also filled to within several feet of high-water, and made of sufficient breadth only, to emit the water of the river, which flows into the basin. The floated sand and mud of this river, thus prevented from being carried out to sea, would, in the course of years, completely fill up the basin.

From some vestiges of the upper carse, as well as of the lower or submarine carse, in situations where their formation cannot easily be traced to any local cause, it seems not improbable that the basin of the German sea itself, nearly as far north as the extent of Scotland, had at one time been occupied with a carse or delta, a continuation of Holland, formed by the accumulation of the diluvium of the rivers which flew into this basin, together with the molluscous exuviæ of the North Sea, and the abrasion of the Norwegian coast and Scottish islands, borne downward by the heavy North Sea swell.

In the case of the delta of Holland having extended so far northward, a subsidence of the land or rising of the sea, so as to form a passage for the waters round Britain, must have occurred. The derangement, at several places, of the fine wavy stratification of these carses, and the confusedly heaped-up beds of broken sea-shells, shew that some great rush of water had taken place, probably when Belgium was dissevered from England. Since the opening of the bottom of the gulf, the accumulation may have been undergoing a gradual reduction, by more diffused mud * being carried off from the German Sea into the Atlantic and North Sea, than what the former is receiving—the same process taking place here as has been occurring in the basin of the Tay. The large sand-banks on the Dutch and English coast,—in some places, such as the Goodwin Sands, certainly the heavier, less diffusible part of the former alluvial country, and portions of these alluvial districts being retained by artificial means,—bear a striking resemblance to the sand-

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* The sea water from Flamborough-head, southward to the Straits of Dover, is generally discoloured with mud; and during every breeze takes up an addition from the bottom, which is an alluvium so unstable and loose, that no sea vegetation can hold in it. From not producing herbage, the general basis of animal life, few fishes or shells can find support in it.

banks of the sea basin of the Tay—the less diffusible remains of the removed portion of the alluvium which had once occupied all that basin, and to the remaining portion of the alluvium also retained by artificial means.

Throughout this volume, we have felt considerable inconvenience, from the adopted dogmatical classification of plants, and have all along been floundering between species and variety, which certainly under culture soften into each other. A particular conformity, each after its own kind, when in a state of nature, termed species, no doubt exists to a considerable degree. This conformity has existed during the last forty centuries. Geologists discover a like particular conformity—fossil species—through the deep deposition of each great epoch, but they also discover an almost complete difference to exist between the species or stamp of life, of one epoch from that of every other. We are therefore led to admit, either of a repeated miraculous creation; or of a power of change, under a change of circumstances, to belong to living organized matter, or rather to the congeries of inferior life, which appears to form superior. The derangements and changes in organized existence, induced by a change of circumstance from the interference of man, affording us proof of the plastic quality of superior life; and the likelihood that circumstances have been very different in the different epochs, though steady in each, tend strongly to heighten the probability of the latter theory.

When we view the immense calcareous and bituminous formations, principally from the waters and atmosphere, and consider the oxidations and depositions which have taken place, either gradually, or during some of the great convulsions, it appears at least probable, that the liquid elements containing life have varied considerably at different times in composition and in weight; that our atmosphere has contained a much greater proportion of carbonic acid or oxygen; and our waters, aided by excess of carbonic acid, and greater heat resulting from greater density of atmosphere, have contained a greater quantity of lime and other mineral solutions. Is the inference then unphilosophic, that living things which are proved to have a circumstance-suiting power—a very slight change of circumstance by culture inducing a corresponding change of character—may have gradually accommodated themselves to the variations of the elements containing them, and, without new creation, have presented the diverging changeable phenomena of past and present organized existence.

The destructive liquid currents, before which the hardest mountains have been swept and comminuted into gravel, sand, and mud, which intervened between and divided these epochs, probably extending over the whole surface of the globe, and destroying nearly all living things, must have reduced existence so much, that an unoccupied field would be formed for new diverging ramifications of life, which, from the connected sexual system of vegetables, and the natural instincts of animals to herd and combine with their own kind, would fall into specific groups, these remnants, in the course of time, moulding and accommodating their being anew to the change of circumstances, and to every possible means of subsistence, and the millions of ages of regularity which appear to have followed between the epochs, probably after this accommodation was completed, affording fossil deposit of regular specific character.

There are only two probable ways of change—the above, and the still wider deviation from present occurrence,—of indestructible or molecular life (which seems to resolve itself into powers of attraction and repulsion under mathematical figure and regulation, bearing a slight systematic similitude to the great aggregations of matter), gradually uniting and developing itself into new circumstance-suited living aggregates, without the presence of any mould or germ of former aggregates, but this scarcely differs from new creation, only it forms a portion of a continued scheme or system.

In endeavouring to trace, in the former way, the principle of these changes of fashion which have taken place in the domiciles of life, the following questions occur: Do they arise from admixture of species nearly allied producing intermediate species? Are they *the diverging ramifications* of the living principle under modification of circumstance? Or have they resulted from the combined agency of both? Is there only one living principle? Does organized existence, and perhaps all material existence, consist of one Proteus principle of life capable of gradual circumstance-suited modifications and aggregations, without bound under the solvent or motion-giving principle, heat or light? There is more beauty and unity of design in this continual balancing of life to circumstance, and greater conformity to those dispositions of nature which are manifest to us, than in total destruction and new creation. It is improbable that much of this diversification is owing to commixture of species nearly allied, all change by this appears very limited, and confined within the bounds of what is called Species; the progeny of the same parents, under great difference of circumstance, might, in several generations, even become distinct species, incapable of co-reproduction.

The self-regulating adaptive disposition of organized life may, in part, be traced to the extreme fecundity of Nature, who, as before stated, has, in all the varieties of her offspring, a prolific power much beyond (in many cases a thousandfold) what is necessary to fill up the vacancies caused by senile decay. As the field of existence is limited and pre-occupied, it is only the hardier, more robust, better suited to circumstance individuals, who are able to struggle forward to maturity, these inhabiting only the situations to which they have superior adaptation and greater power of occupancy than any other kind; the weaker, less circumstance-suited, being prematurely destroyed. This principle is in constant action, it regulates the colour, the figure, the capacities, and instincts; those individuals of each species, whose colour and covering are best suited to concealment or protection from enemies, or defence from vicissitude and inclemencies of climate, whose figure is best accommodated to health, strength, defence, and support; whose capacities and instincts can best regulate the physical energies to self-advantage according to circumstances—in such immense waste of primary and youthful life, *those* only come forward to maturity from the strict ordeal by which Nature tests their adaptation to her standard of perfection and fitness to continue their kind by reproduction.

From the unremitting operation of this law acting in concert with the tendency which the progeny have to take the more particular qualities of the parents, together with the connected sexual system in vegetables, and instinctive limitation to its own kind in animals, a considerable uniformity of figure, colour, and character, is induced, constituting species; the breed gradually acquiring the very best possible adaptation of these to its condition which it is susceptible of, and when alteration of circumstance occurs, thus changing in character to suit these as far as its nature is susceptible of change.

This circumstance-adaptive law, operating upon the slight but continued natural disposition to sport in the progeny (seedling variety), does not preclude the supposed influence which volition or sensation may have over the configuration of the body. To examine into the disposition to sport in the progeny, even when there is only one parent, as in many vegetables, and to investigate how much variation is modified by the mind or nervous sensation of the parents, or of the living thing itself during its progress to maturity; how far it depends upon external circumstance, and how far on the will, irritability and muscular exertion, is open to examination and experiment. In the first place, we ought to investigate its dependency upon the preceding links of the particular chain of life, variety being often merely types or approximations of former parentage; thence the variation of the family, as well as of the individual, must be embraced by our experiments.

This continuation of family type, not broken by casual particular aberration, is mental as well as corporeal; and is exemplified in many of the dispositions or instincts of particular races of men. These innate or continuous ideas or habits, seem proportionally greater in the insect tribes, those especially of shorter revolution; and forming an abiding memory, may resolve much of the enigma of instinct, and the foreknowledge which these tribes have of what is necessary to completing their round of life, reducing this to knowledge, or impressions, and habits, acquired by a long experience. This greater continuity of existence, or rather continuity of perceptions and mpressions, in insects, is highly probable; it is even difficult in some to ascertain the particular stops when each individuality commences, under the different phases of egg, larva, pupa, or if much consciousness of individuality exists. The continuation of reproduction for several generations by the females alone in some of these tribes, tends to the probability of the greater continuity of existence, and the subdivisions of life by cuttings, at any rate must stagger the advocate of individuality.

Among the millions of *specific varieties* of living things which occupy the humid portion of the surface of our planet, as far back as can be traced, there does not appear, with the exception of man, to have been any particular engrossing race, but a pretty fair balance of powers of occupancy,—or rather, most wonderful variation of circumstance parallel to the nature of every species, as if circumstance and species had grown up together. There are indeed several races which have threatened ascendency in some particular regions, but it is man alone from whom any general imminent danger to the existence of his brethren is to be dreaded.

As far back as history reaches, man had already had considerable influence, and had made encroachments upon his fellow denizens, probably occasioning the destruction of many species, and the production and continuation of a number of varieties or even species, which he found more suited to supply his wants, but which, from the infirmity of their condition—not having undergone selection by the law of nature, of which we have spoken, cannot maintain their ground without his culture and protection.

It is, however, only in the present age that man has begun to reap the fruits of his tedious education, and has proven how much "knowledge is power." He has now acquired a dominion over the material world, and a consequent power of increase, so as to render it probable that the whole surface of the earth may soon be overrun by this engrossing anomaly, to the annihilation of every wonderful and beautiful variety of animated existence, which does not administer to his wants principally as laboratories of preparation to befit cruder elemental matter for assimilation by his organs.

In taking a retrospective glance at our pages from the press, we notice some inaccuracy and roughness, which a little more timely attention to *training* and *pruning* might have obviated; the facts and induction may, however, outbalance these.

We observe that Fig. *d*, p. 27, from the want of proper shading, and error in not marking the dotted lines, does not serve well to illustrate our purpose. This figure is intended to represent a tree of a short thick stem, dividing into four branches, springing out regularly in the manner of a cross, nearly at right angles with the stem. These branches cut over about three or four feet out from the division, form each one wing of a knee, and the stem, quartered longitudinally through the heart, forms the other wing. It is of great advantage to have four branches rather than two or three, as the stem, divided into four, by being twice cut down the middle, forms the wings nearly square; whereas, when divided into two, the halves are broad and flat, and a considerable loss of timber takes place; besides, the two branches afford a thicker wing than the flat half of the stem does when squared. When the tree separates into three branches, the stem does not saw out conveniently; and when divided, the cleft part is angular, and much loss of timber also takes place in the squaring. When the stem divides into four branches, each of these branches coincides in thickness with the quartered stem, and the knees are obtained equally thick throughout, without any loss of timber. The four branches, at six or eight feet above the division, may with a little attention be thrown into a rectangular bend, and thus give eight knees from each tree. Knees are generally required of about eight inches in diameter, and three and a half feet in length of wing; but when they are to be had thicker and longer, a foot or more in thickness, and from four to ten feet in length of wing, they are equally in request, suiting for high rising floors or heel-knees.

The directions for forming larch roots into knees after the tree is grubbed, are also not very explicit. The stem of the tree is cut over nearly the same distance from the bulb as the length of the root spurs; this quartered through the heart (in the same manner as above), forms one wing of the knee, and the four spurs form the other wings. The same advantage results from having four regular root-spurs in larch, as in having four regular branches in oak: the two processes are quite similar, only the roots in the one case, and the branches in the other, form one wing of the knees.

We have given no directions for the bending of plank timber. In larch, the wind generally gives the slight necessary bend to a sufficient proportion; and in oak, the trees frequently grow a little bent of their own accord.

A foot-note has been omitted, stating, that the plan of bending young trees, by tying them to an adjacent tree, intended to be soon removed, belongs, as we are informed, to Mr Loudon.

We regret that our allusion to the lamented Mr Huskisson was printed off before we knew of his death.

Since this volume went to press, there has been some changes of scenery on the political European stage, *even rivalling* what has ever been accomplished of sylvan metamorphosis on the face of nature by Sir Henry Steuart. The intense interest excited by these efforts towards the regeneration of man, has completely thrown into shade our humbler subject—the regeneration of trees. We have even forgot it ourselves in the hands of the printer, while yet unborn. These sudden transformations altering the political and moral relations of man, also render a number of our observations not quite apposite, and our speculations, some of them, rather "prophetic of the past." They, by obliterating national distinctions, and diminishing the occasions for going to war, will, it is hoped, bring the European family closer into amity. At any rate, they have completely thrown out the calculations of our politicians regarding the balance of power and international connection as natural allies and foes, and bind the French and the British together by ties on the surest principle of friendly sympathy, "*idem velle atque nolle*," which no Machiavellian policy of cabinets, nor waywardness of political head, will be able to sunder.

We had intended to bring out Naval Timber and Arboriculture as a portion of a work embracing Rural Economy in general, but this is not a time to think of rural affairs.

FINIS.

ERRATA.

Page 10, top line, *for* they *read* the branches
18, line 13. from bottom, *for* under *read* within
18, line 8. from bottom, *for* long *read* in length of wing
22, *insert* f *at fig. on right-hand side of wood cut.*
26, line 8. from bottom, *for* 5 *read* 3
57, line 4. from top, *for* any *read* many
78, line 11. from top, *for* latitude *read* altitude
87, line 9. from top, *dele* may also in some degree
—, line 10. from top, *for* diminish *read* diminishing
—, line 11. from top, *for* increase *read* increasing
205, line 12. from top, *dele* generally esteemed
206, bottom line, *for* lineal *read* large
218, line 5. from bottom, *for* ground *read* portion
220, line 7. from bottom, *after* soil *insert a semicolon*
222, line 14. from top, *for* latterly *read* laterally
223, line 13. from top, *for* falling *read* felling
242, line 12. from top, *for* into *read* in, to
280, line 14. from top, *for* the *read* this
285, top line, *after* n *insert* o
300, line 2. from bottom, *dele* of
327, line 6. from bottom, *for* that dew, *read* dew, that
331, line 10. from bottom, *for* root *read* row
372, line 14. from top, *for* tend *read* tends